SERVICE MANUAL

GS-1200

ELMO CO.,LTD.

Nagoya, Japan

I N T R O D U C T I O N

1. Refer to the TROUBLE INDEX on Page 7 in order to find the page to be referred to in accordance with trouble.

2. Refer to the DISASSEMBLY STEPS on Page 4 to reach the defective parts.
For example, when you remove the Amplifier, you should take off the Front Cover (Page 10), Rear Cover (Page 12), Amplifier Cover (Page 14) and Amplifier (Page 116) in order.

   Disassembly order in a section in "VI. DISASSEMBLY & REASSEMBLY NOTES" is as follows:

   First ..... HOW TO DETACH A UNIT ASSEMBLY FROM THE PROJECTOR
   Next ..... HOW TO DISASSEMBLE THE UNIT ASSEMBLY AND SO ON

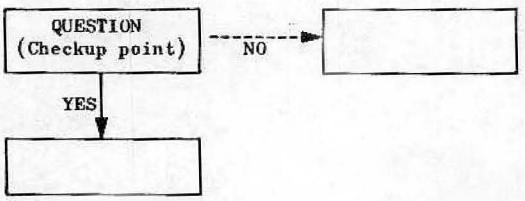
   * Refer to the Parts List for the GS-1200, which will serve you when disassembling the projector.

3. TROUBLESHOOTING is shown in the head part of each article in "VI. DISASSEMBLY & REASSEMBLY NOTES". Please be careful in DISASSEMBLING and REASSEMBLING the parts not to cause other troubles.

4. The CIRCUIT ANALYSIS is on Page 93, which explicates the logical circuit used in the GS-1200.

5. How to read the troubleshooting flow chart:

   ANSWER
   YES .... follow the under box
   NO .... follow the right box



K E Faulkner

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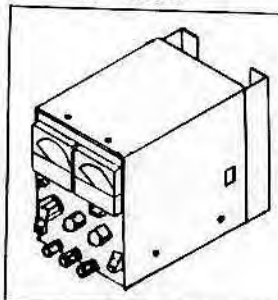
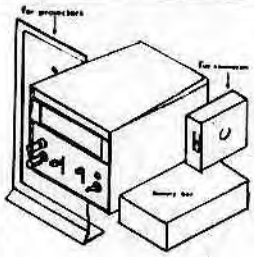
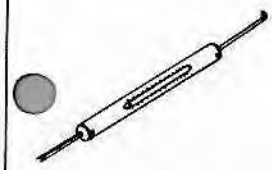
I. TOOLS



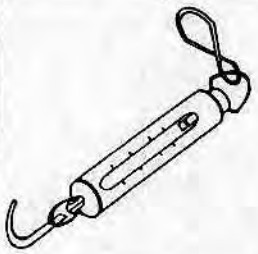
Code No.	: C004
Name	: DC regulated power-supply
Weight	: 3.8 kgs.
Dimensions:	105 x 160 x 220mm
Page	: 60, 64



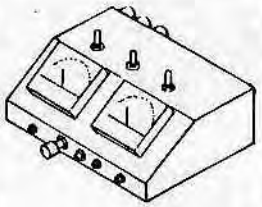
Code No.	: C005
Name	: Frequency counter
Weight	: 1.7 kgs.
Dimensions:	130 x 135 x 180mm
Page	: 86



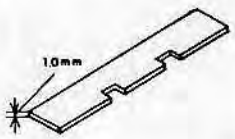
Code No.	: C043
Name	: Bar spring scale 110g
Weight	: 40g
Dimensions:	10 dia. x 280mm
Page	: 20,24,40,46,60,64



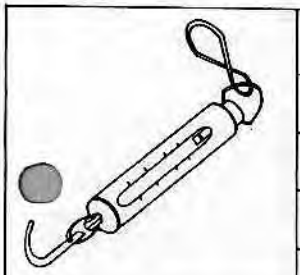
Code No.	: P026
Name	: Bar spring scale 500g
Weight	: 110g
Dimensions:	37 dia. x 180mm
Page	: 24, 46



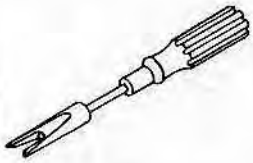
Code No.	: P045
Name	: Resistor box 8 ohms 40W
Weight	: 1.1 kgs.
Dimensions:	90 x 190 x 200mm
Page	: 49,50,51,52,54,55,56



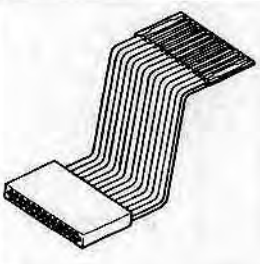
Code No.	: P047
Name	: Claw tip length gauge
Weight	: 3.7g
Dimensions:	60 x 8 x 1mm
Page	: 24



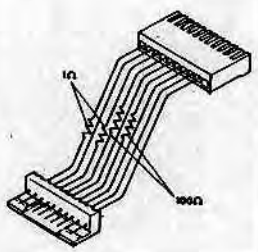
Code No.	: P048
Name	: Bar spring scale 1 kg.
Weight	: 110g
Dimensions:	37 dia. x 180mm
Page	: 24



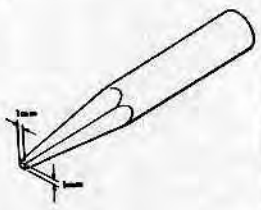
Code No.	: P055
Name	: Claw adjust-driver
Weight	: 70g
Dimensions:	23 dia. x 70mm
Page	: 24



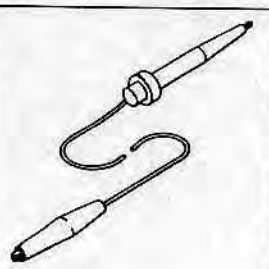
Code No.	: P056
Name	: Board connection cord
Weight	: 85g
Dimensions:	300mm long
Page	: 123-152
	Amp. board -- Control board
	Amp. board(1) -- Amp. board (2)



Code No.	: P057
Name	: Current check cord
Weight	: 10g
Dimensions:	25.5 x 6 x 120mm
Page	: 164



Code No.	: P058
Name	: Trap coil adjust-bar
Weight	: 7g
Dimensions:	8 dia. x 120mm
Page	: 164



Code No.	: P059
Name	: Circuit check cord
Weight	: 32g
Dimensions:	800mm long
	for connecting and grounding the circuit

II. TEST FILMS & OIL/GREASE

A. Test Films

Code No.	Film	Page
P027	Pre-striped film (4KHz signal recorded at 24 fps)	49
P051	Super-8 optical frequency response film 400Hz	55, 56
P053	Super-8 optical frequency response film 4KHz	54, 56
P054	Resolving power film, Type S	20, 26, 34

B. Oil/Grease

The mark in disassembly drawing shows you the point to be lubricated.
The letters A, B, C, D & E in the mark show you the kind of oil/grease as listed below.
Use the regulated oil/grease to keep the projector in the original condition.

Mark		Brand Name
	A	DAPHNE 44
	B	VEEDLE 20-40
	C	ALVANIA GREASE 2
	D	ALUMINUM GREASE 1
	E	MOLYKOTE EP

III. DISASSEMBLY STEPS

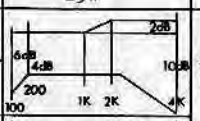
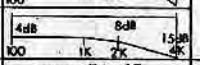
- Front cover (Page 10)
- Rear cover (Page 12)
- Machine frame (Page 16)
- Cancel coil printed circuit board (Page 36)
  - Sound frame (Page 36)
- Main motor (Page 70)
  - Heat-proof glass solenoid (Page 72)
- Fan motor (Page 70)
  - Heat-proof glass (Page 72)
- Rewinding motor (Page 64)
  - Front arm (Page 66)
- Amplifier cover (Page 14)
  - Amplifier (Page 116)
  - Take-up guide (Page 74)
  - Power switch block (Page 80)
- Control circuit board (Page 86)
- ESS circuit board (Page 82)
- Transformer (Page 78)
  - Take-up motor (Page 60)
    - Rear arm (Page 62)
- Head presser solenoid & Pad roller lever pressing solenoid (Page 48)

- Film guide (Page 74)
- Combination head (Page 42)
- Light section (Page 76)

- Cancel coil printed circuit board (in case that you need not remove sound frame) (Page 36)
  - Operation switch block (Page 114)

IV. TOLERANCE

Item		Tolerance	Measurement	Page
Spring pressure of pressure plate		60-70g	Hook a scale 110g C043 on a film and hold it up.	33
Spring pressure of side presser		30-35g	Use a tension gauge 50g C063.	19
Tension of claw braking spring		60-70g	Hook a scale C043 on claw and pull it in the turning direction.	23
Tension of claw spring	Shaft direction	450-500g	Near claw pin. Use a scale 1 kg C026.	23
	Forward direction	850-950g	Near claw pin. Use a scale 1 kg C048.	23
Claw tip protrudent length		1.0-1.1mm	Length from aperture plate rail. Use a gauge C047.	23
Framing (up and down)		3 lines	Three lines should appear up and down. Use a test film, type S.	25
Unstable picture	Forward	2.0mm	Picture size: 50cm in width. Speed: 24 fps.	
	Reverse	2.5mm		
	Reverse	2.0mm		
18/24 speed		±0.3 fps	With a rating voltage. After 5 minutes running.	87
Speed fine adjustment		24±2 fps		
Take-up tension		40-50g	Use a 800ft reel and a scale C043. At 18 fps.	60
Rewinding tension		200±30g	Use a 800ft reel and a scale C043. At 18 fps.	64
Rewinding speed		150±20 sec	Time for rewinding a 1200ft film.	
Illuminance	Center	over 1450 lx	Picture size: 50cm in width.	76
	Corner	over 53%	With respect to a center.	76
	Lumen	over 220 lm	Screen lumen.	76
Projection lamp voltage	High	23.75V	On transformer terminal. With a rating voltage.	77
	Low	21.6V		
Projection lamp life		25 hours	Lamp switch knob on High side.	
Dissolving power		20	Left mark should clearly be distinguished. (4 Corners)	
Spring pressure of pad lever		250-300g	On FWD condition. Use a scale 500g C026.	45
Spring pressure of head presser (2)		20-22g	Use a tension gauge 50g C063.	45
Spring pressure of back tension roller		70-80g	Use a tension gauge 200g.	45
Spring pressure of arm		0.9-1.1 kg	Hook a scale 2 kgs. P046 on arm tip.	
Film scratch			Hurtful scratch shouldn't appear after 10 times running of black film.	
Noise		60 phon	Away from aperture plate at 1m in 24 fps projection.	
Tilting angle		over 7°		
Horizontal correcting angle		over +1°	Picture size: 50cm in width. Adjustable over +8mm.	
Insulation resistance		over 10 megohm	Use a 500V megger.	

Item			Tolerance	Measurement	Page
Amp. output		Continuous power	10W	Both tracks 1 & 2 Load an 8 ohms resistor.	48
		Maximum power	15W		
Frequency response	MAG.	Track 1 18 fps 24 fps		Record signals with 0 VU at 18 fps. Use "Toyo film" when checking at 24 fps.	52, 56
		Track 2 18 fps 24 fps			
	OPT.				
S/N ratio	MAG.	Track 1	over 50 dB	Rating 10W (8 ohms) output thru A.W.N. circuit.	49, 55
		Track 2	over 45 dB		
	OPT.		over 45 dB		
Distortion	MAG.	both tracks	less than 4%	Rating 10W (8 ohms) output	49, 55
	OPT.		less than 4%		
Erasing effect		both tracks	less than -40dB	Speed: 18 fps. Input: 0 VU. Rating 10W (8 ohms) output thru A.W.N. circuit.	51
Noise level	MAG.	both tracks	less than 20mV	Set to FWD thru A.W.N. circuit. Maximum volume.	49, 50
	OPT.		less than 20mV		
Wow/Flutter CCIR		WTD	less than 0.4%	Record at 18 fps. Move a sprocket at 12 teeth.	
		LINE	less than 0.7%		
		FUL	less than 0.4%		
Transferring recording		Track 1 to 2	over -6 dB	Transfer at 0 VU a 400Hz signal recorded at -10 VU.	51
		Track 2 to 1			
Bias oscillation frequency			60KHz±5K		
Bias current		Track 1	400±15μA	Set both tracks to recording state. Connect a 100 ohms resistor across a ground wire on track 1 side. Measure voltage across it. In case of track 2, connect the resistor on track 2 side.	161
		Track 2	400±15μA		
Recording signal current		Track 1 400Hz	55μA	Cut a bias power-supply. Measure the current in the same manner as bias measurement.	
		Track 2 400Hz	45μA		
Erasing current		Track 1	over 110mA	Set both tracks to recording state. Connect a 1 ohm resistor across a ground wire of track 1 E.H. Measure voltage across it. In case of track 2, connect the resistor on track 2 side.	161
		Track 2	over 110mA		
Exciter lamp current			0.75±0.01A	Measure with an exciter lamp wire.	161

	Trouble	Page
Film transportation & Auto-threading	Unstable picture	20,22,28,30,34
	Film flow	22, 28
	Picture inclination	20
	Picture out of position	20
	Picture flicker	28
	Sometimes out of focus	34
	Uneven focus	34
	Film scratch	20,32,34,36,38, 40,42,74
	Running noise	22, 28
	Upper loop is getting shorter in REV - ditto - in REV at OPT	32
	Lower loop isn't formed (OPT)	34
	Loop-sensor function is defective	38
	Unable to set to the auto-threading	36
	Unable to release the auto-threading	30
	Film is interrupted in auto-threading	16, 30, 74
	Difficult to take off the film	30, 42
	Image trails	38
	Slow running	22
		22, 28
Take-up & Rewind	Take-up is defective	60
	Take-up power is weak	60
	Take-up power is too strong	62
	Rewinding is defective	64
	Rewinding power is weak	64
	Rewinding power is too strong	64, 66
	High speed rewinding is defective	68
	Noise from rear arm	62
Motor	Main motor doesn't run	70, 78
	Noise from main motor	70
	Slow running of main motor	70, 78
	Fan motor doesn't run	70, 78
	Noise from fan motor	70
	Speed of fan motor isn't changed	70
	Take-up & rewinding motors don't run	60, 64, 78

	Trouble	Page
Projection Lamp	It doesn't light	76
	Uneven illuminance	72, 76
	Changeover of H-L is defective	80
	It isn't pre-heated	80
	Dark picture	72, 76
	Difficult to replace it	72
	Unstable lighting	76
Control Circuit & Others	Control circuit board defective	86-92
	Motor won't run with FWD key operation	78,100,102,114
	Motor won't run with REV key operation	104,105,114
	Motor won't stop with STOP key operation	114
	Unable to set to STILL projection	10,105,106,114
	ESS sync defective	22,83,84,86
	ESS malfunction	82,109,110,111
	Speed of FAST/SLOW isn't adjustable	82
	Unable to record & play back ESS pulse	82
	Solenoids (for head presser & pad roller lever) don't work	48
	Lamp relay isn't workable	80
	Unable to shift 18-24 fps	82
	Unable to fine adjust speed of 18-24 fps	82
	Main motor revolution is out of regulated number	86
	No power though power switch is ON	80
	Unable to shift MAG-OPT system	116
	Unable to shift STEREO-MONO system	116
	REC button malfunction	118
	Spot recording button malfunction	118
	Volume knob turn isn't proper	118
	Film damage in still projection (6 fps)	72
	Film counter isn't workable	68
	Pilot lamp doesn't light	78
	Noise in forwarding	60
	Noise in reversing	64, 66

		Trouble	Page
SOUND	Optical	Unable to playback	54, 126
		Poor sound quality	54
		Small sound	54
		Hum	54, 134
		Unable to playback high frequency range	54
		Oscillation	137, 138
		Wow/Flutter	38
		Quick-sound-start system won't work	16, 38
	Magnetic Playback	Wow/Flutter	16,28,32,36, 38,40,42,46, 48,58,86
		Poor sound quality	12, 40
		High frequency range isn't played back	40, 42
		Unable to playback	12,78,118, 123,124,125
		No sound thru speaker (track 1)	123
		No sound thru speaker (track 2)	124
		No sound thru speaker (both tracks)	125
		No deflection of level meter (1) or (2)	127
		Neither level meter swings	127
		Indication of level meter (1) or (2) differs with that in recording	140
		No signal from AUX OUT (1) or (2)	128
		Neither AUX OUT line works	128
		No sound from either MONI	129
		No sound from stereo headphone	129
		No sound from EXT. SP (1) or (2)	129
		No sound thru PA system	131
		Stereo system isn't workable	132
		Loud hum from each speaker	133
		Oscillation in magnetic playback	133, 136
		Muting circuit (1) or (2) isn't workable	139
		Neither muting circuit is workable	139

		Trouble	Page
SOUND	Recording	Unable to record on track 1 or 2	141, 142
		Unable to record on both tracks	143
		Unable to erase sound on track 1 or 2	40, 144
		Unable to NORMAL record on track 1 or 2 (DOUBLE recording is OK)	145
		ALC of track 1 or 2 isn't workable	145
		Neither ALC is workable	145
		No deflection of level meter (1) or (2) (Recording itself is OK)	146
		Unable to DOUBLE record on track 1 or 2 (NORMAL recording is OK)	146
	Recording/Playback Shifting Solenoid	Solenoid (1) or (2) doesn't work	147
		Neither solenoid works	148
		This (1) or (2) won't work though FWD button is pushed together REC button	149
		Both of them won't work through FWD button is pushed together REC button	149
		Spot recording isn't performed (Other recordings are OK)	149
		Solenoid terribly vibrates with REC button operation	149
		Unable to put spot recording condition back	149
		Once operated, solenoid won't put back though OFF button is pushed	150
		As soon as power is applied, solenoid works	151
		Solenoid works with only shifting to READY or M position, without REC button	151
		Amplifier fuse burns	152

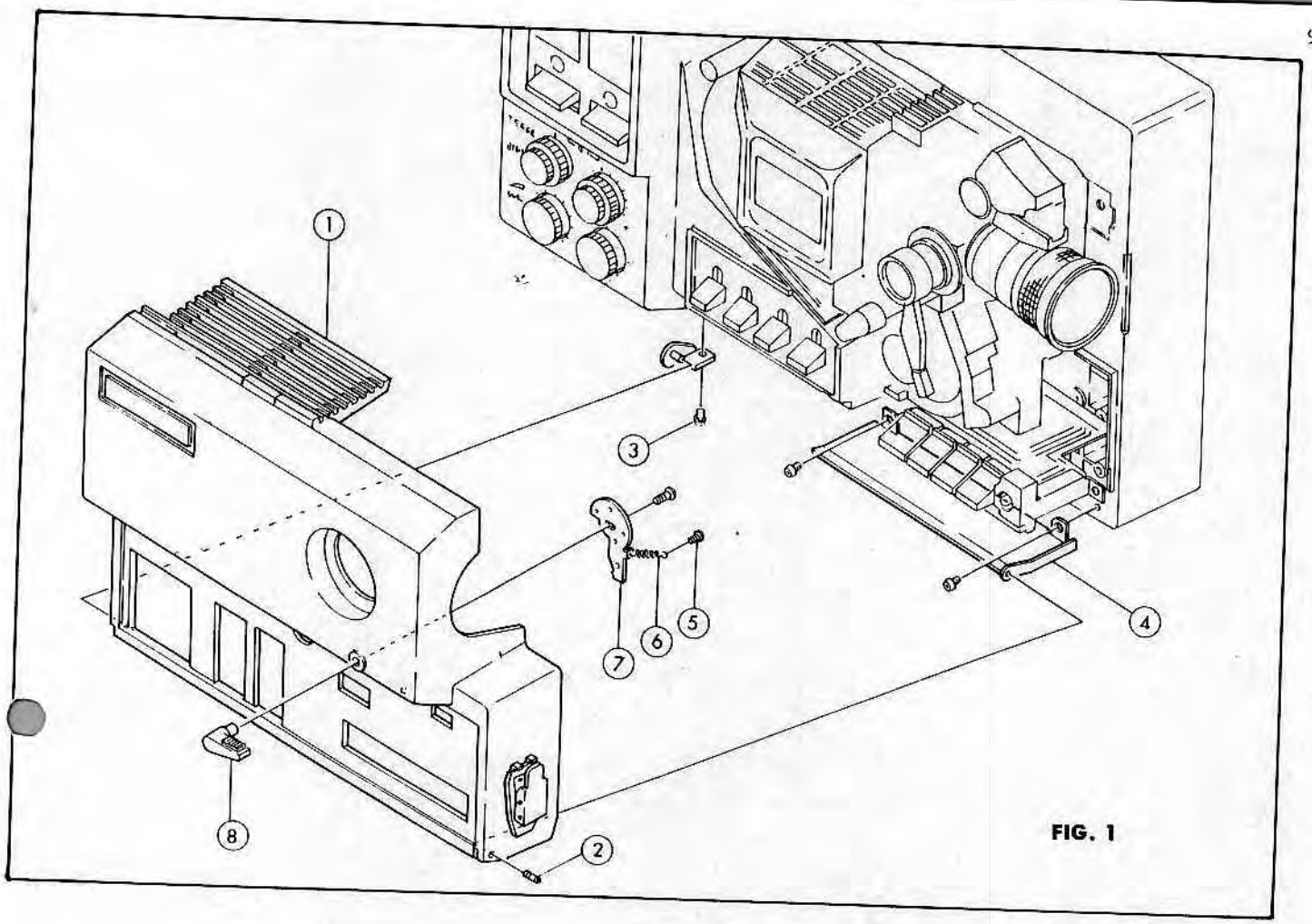


FIG. 1

VI. DISASSEMBLY & REASSEMBLY NOTES

1. APPEARANCE PARTS

A. Front Cover (1)

TROUBLESHOOTING: (Refer to Fig. 1)

Trouble	Cause
Unable to push a STILL button fully	The (4) is fixed incorrectly.

DISASSEMBLY:

1. Unscrew the (2). Loosen the (3) and remove the (1).
2. Go on with disassembly works, referring to Fig. 1.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that the (8) functions smoothly.

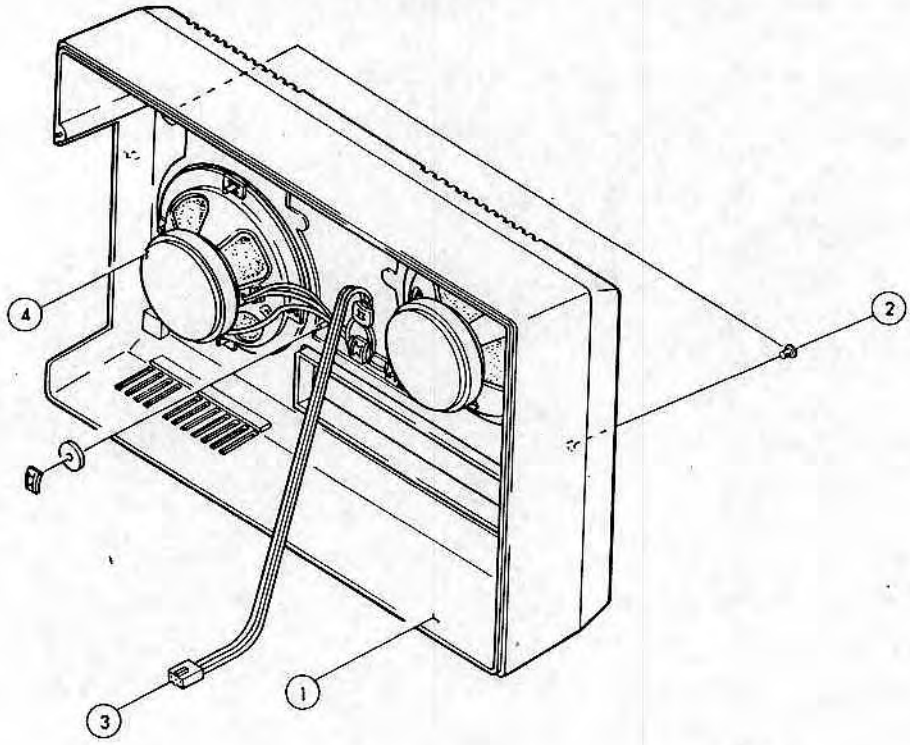


FIG. 2

B. Rear Cover (1)

TROUBLESHOOTING: (Refer to Fig. 2)

Trouble	Cause
No sound from a speaker	The (4) is broken or the (3) is connected loosely.
Bad tone quality	

DISASSEMBLY:

1. Unscrew the (2)x2 and take off the (1) after disconnecting the (3).
2. Go on with disassembly works, referring to Fig. 2.

REASSEMBLY NOTES:

Follow the reverse way of the disassembly steps.

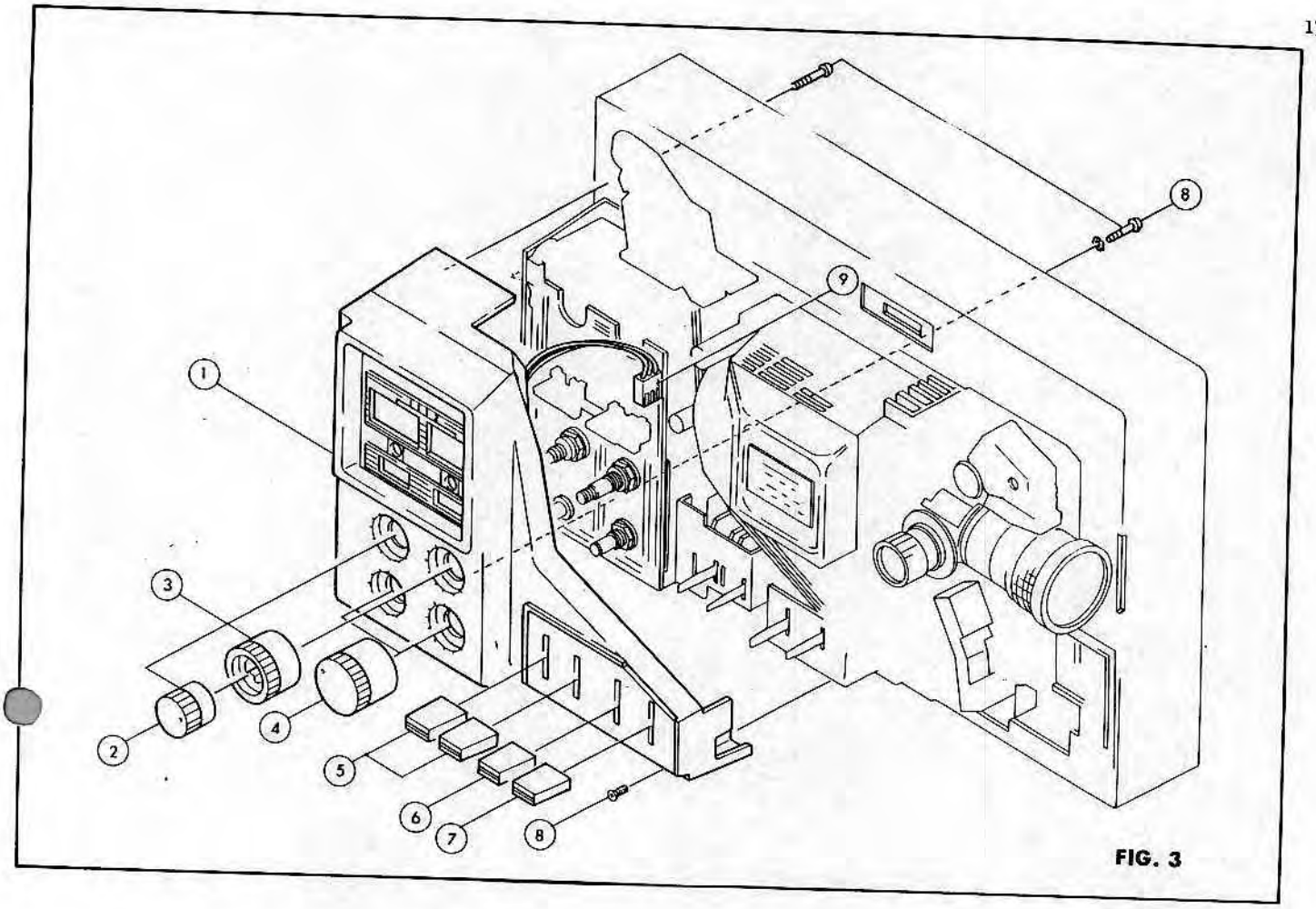


FIG. 3

C. Amplifier Cover (1)

DISASSEMBLY: (Refer to Fig. 3)

1. Pull out the ten knobs: 2 pcs. each of the (2)(3)(4)(5) and 1 pce. each of the (6)(7).

   They are inserted rather hard.

2. Unscrew the (8)x3 and take off the (1) after disconnecting the (9).

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Difference in color among knobs is as follows.

   The (5) is black with a white line.
   The (6) is silver with a yellow line.
   The (7) is silver with a red line.

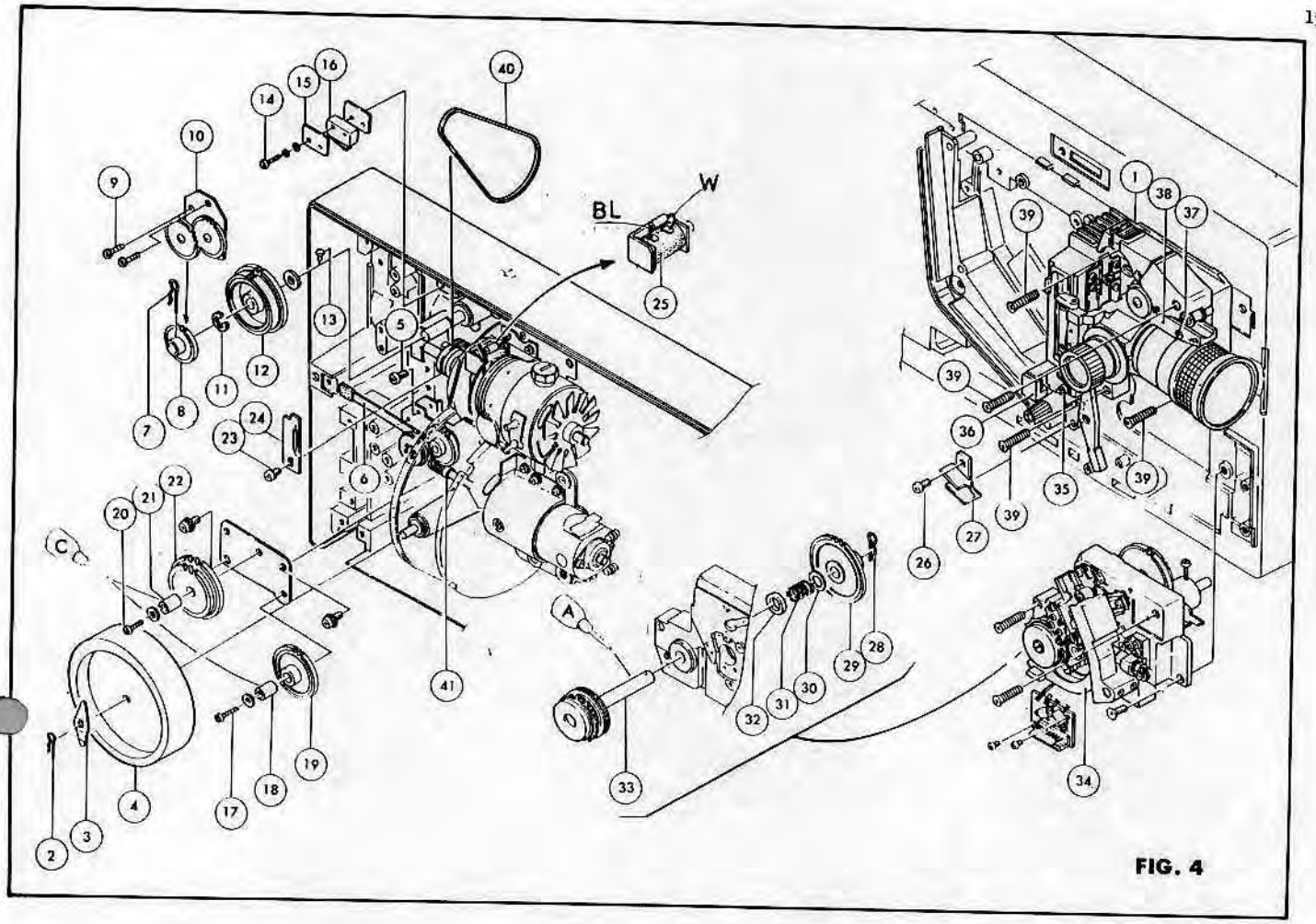


FIG. 4

2. MACHINE FRAME SECTION

A. Machine Frame Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 4)

Trouble	Cause	Reference
Unable to set back auto-threading condition	Defect of the (16) or its electric circuit. The (16) is out of position. Defect of the (25) or its electric circuit.	
Wow/Flutter	The gears (12)(19)(22)(29) have burrs or dust, causing irregular turn. Wash off the dust or replace gears. The (6) is incorrectly positioned	Page 18 REASSEMBLY NOTES No. 2
Time when sound becomes normal is too long	The (6) is out of position.	

DISASSEMBLY:

1. Take off the parts from the (2) to (12). The (13) will fall off.
2. Unsolder the two wires connected to the (16) from the relay board.
   You, however, may remove the (16) after unscrewing the (14)x2.
3. Take off the (17)(20)(19)(22) respectively. The (18)(21) will fall off.
4. Unscrew the (23) and remove the (24). You need not unsolder the wire connected to the (24).
5. Unsolder the two wires from the (25).
6. Unscrew the (26) and remove the (27).
7. Remove the (28). As holding the (29) and pushing the (34) down, pull out the (33).
   The (30)(31)(32) will fall off.
8. Unscrew the (35) and remove the (36). You need not unsolder the wire connected to the (36).
9. Unscrew the (37) and remove the (38).
10. Unscrew the (39)x4, take off the (30) and remove the (1).

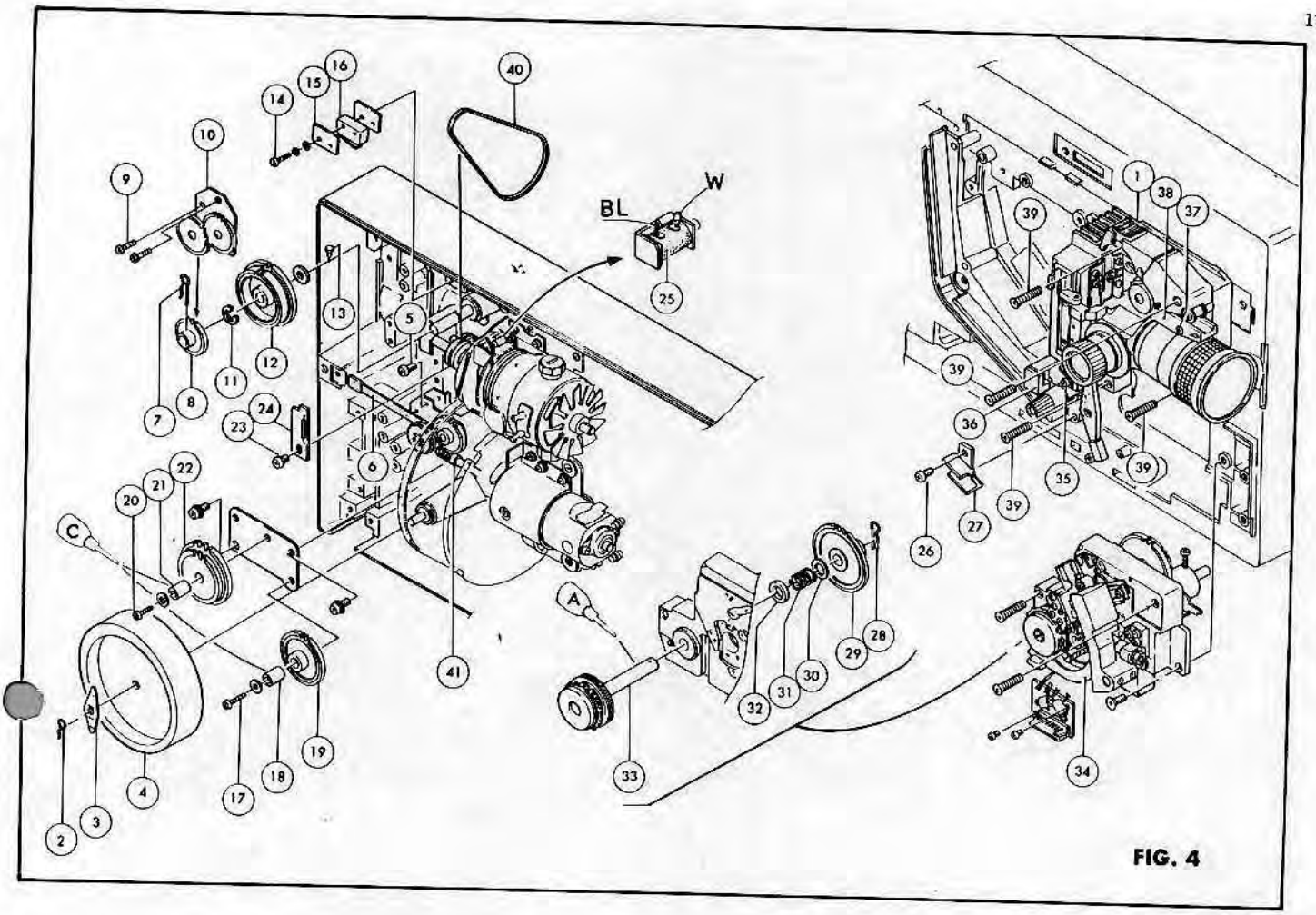


FIG. 4

A. Machine Frame Assembly (1) (Cont'd)

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. After adjusting the engagement of the (6) and (41), tighten them with the (5) temporarily. The (6) is naturally in contact with the (4) and the (4) is able to turn by the (6). Adjust the attaching position of the (6) and fan motor (No.2 on Page 69) so that the (6) can get away from the (4) as soon as FWD button is depressed. After this work, tighten the (6) firmly.
3. Attach the (16) in place where it turns on when an auto-threading button (No.1 on Page 30) is depressed.
4. Attach the (24) in place where the reed switch on it can turn ON in the ratio of 1 time/1 frame. Use a tester for the above checking.
5. After attaching the (29)(28), make sure that "a" surface of the (29) is in contact with the (28) closely. If not, pull the (29) in the arrow direction in Fig. 4-A.
6. Make sure that gears have no crack and no dust prior to the attaching works.
7. Attach gear so that there is a backlash.
8. Don't damage the (36)'s wires. If they short, fuse will burn.

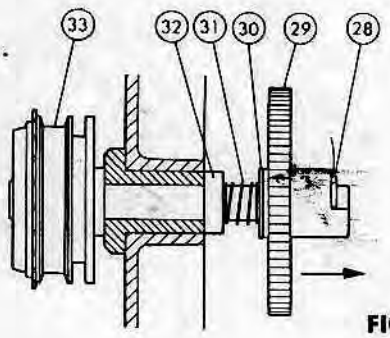


FIG. 4-A

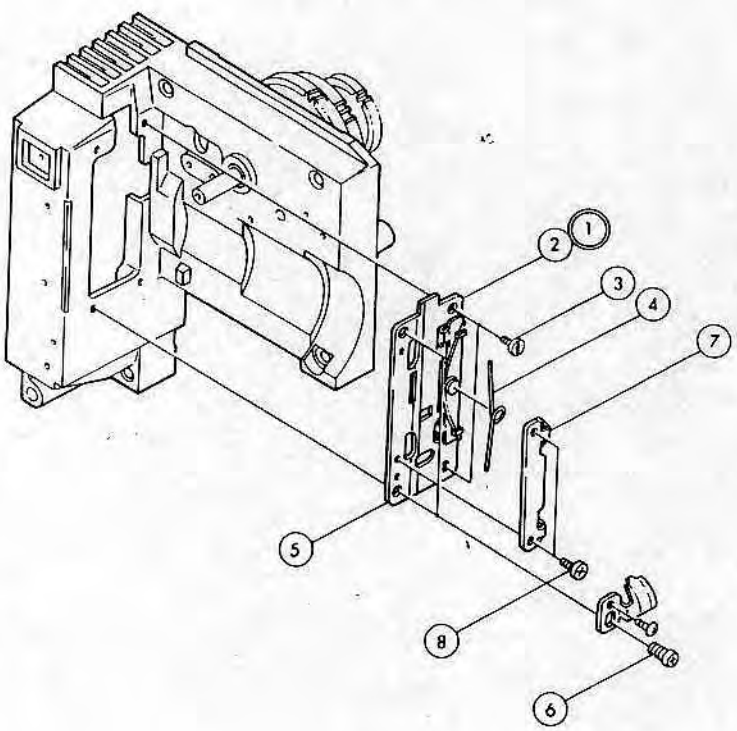


FIG. 5

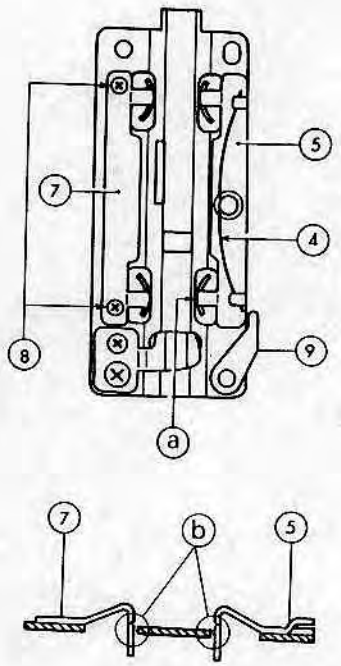


FIG. 5 – A

B. Aperture Plate ((1))

TROUBLESHOOTING: (Refer to Fig. 5)

Trouble	Cause
Film scratch	Flaw on the aperture plate rail.
Unstable picture (right/leftward)	The spring pressure of the (4) is improper.
Picture inclination, Unstable picture, Picture out of position (right or left)	The (7) is out of position or worn-out as shown in Fig.5-A-b.
Unstable picture (new printed film)	The (5)'s position is improper.

DISASSEMBLY:

1. Remove the film insertion entrance, first sprocket shoe, first sprocket and auto-threading button, referring to Page 32.
2. Unscrew the (3), (6)x3 and remove the ((1)).

REASSEMBLY NOTES:

1. Before attaching the ((1)) to the machine frame, make sure that the aperture plate rail has no flaw and that the (5) moves smoothly without burrs or camber.
2. Follow the reverse way of the disassembly steps.
3. When attaching the ((1)) to the machine frame, tighten the screws (3) and (6)x3 in this order.
4. After fixing the (4) to (5), measure of the spring pressure (30-40g) at "a" point in Fig. 5-A. Use a spring scale C043.
5. Attach the (7) with (8)x2 in place where the image can appear fully in every direction without inclination.

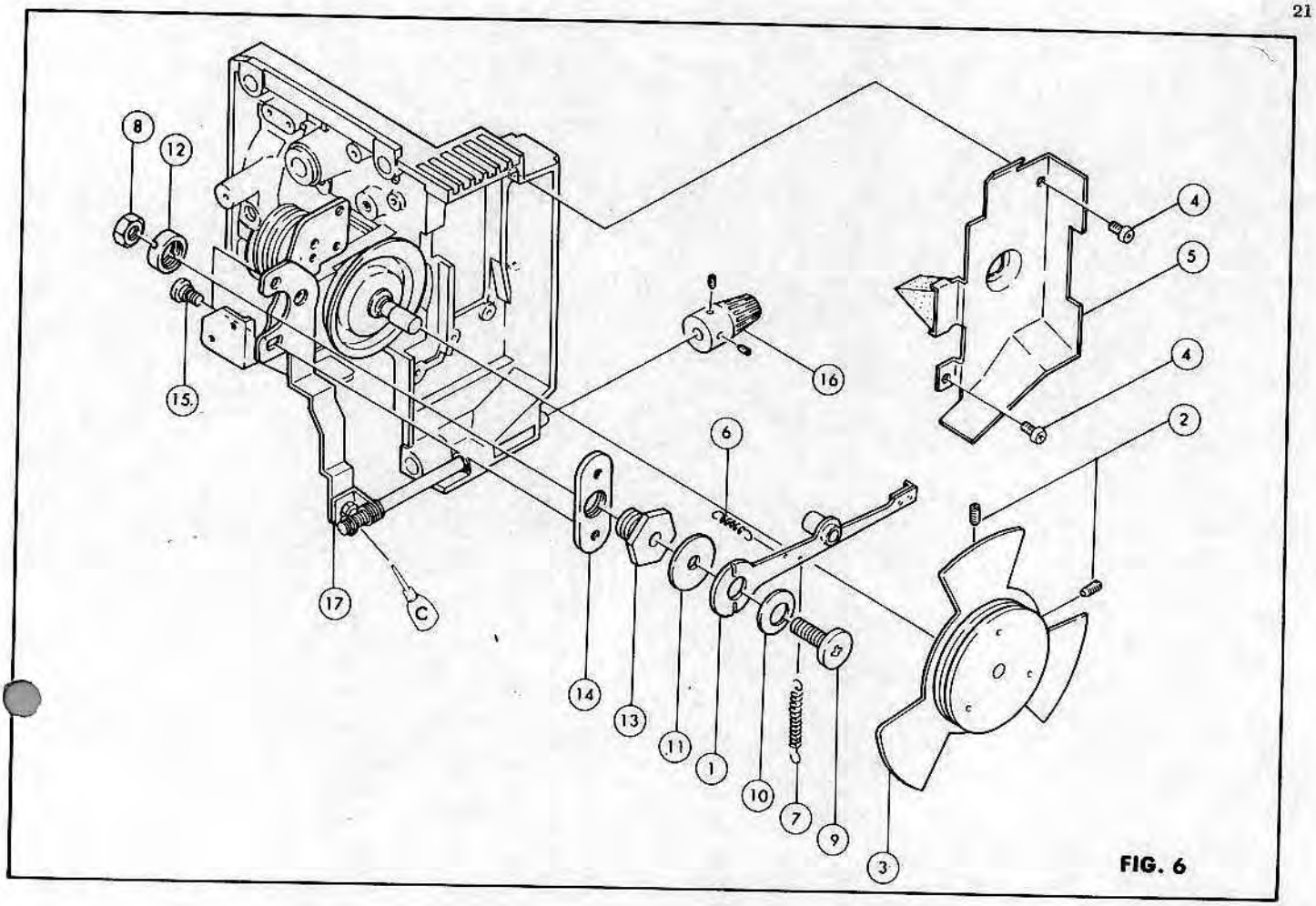


FIG. 6

C. Sending Claw Assembly (1) and Shutter (3)

TROUBLESHOOTING: (Refer to Fig. 6)

Trouble	Cause	Reference
Shutter flows (Picture trails)	The (3) is out of position.	Page 26
Film flows	The claw tip doesn't protrude fully from the aperture place surface (1.0mm is proper).	Page 24
Running noise	The (1) is worn-out. The spring pressure of (6)(7)(10) is improper.	Page 24
Unstable picture (up/downward)	The spring pressure of (6)(7)(10) is improper.	Page 24
Unstable picture (left/rightward)	The (1) is out of position.	Page 24
Unstable picture (sent backward)	the claw tip protrudes excenssively.	Page 24
Slow running	Oil adheres to the pulley of the (3).	

DISASSEMBLY:

1. Take off the (3) after unscrewing the (2)x2.
2. Take off the (5) after unscrewing the (4)x2.
3. Unhook the (6)(7).
4. Take off the (9) after unscrewing the (8) and then remove the (1). The (10)(11) will fall off.
5. For further disassembly, refer to Fig. 6.

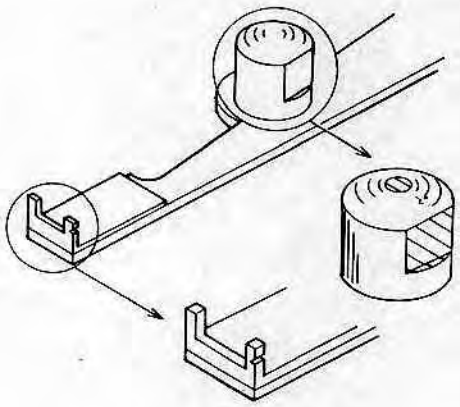


FIG. 7

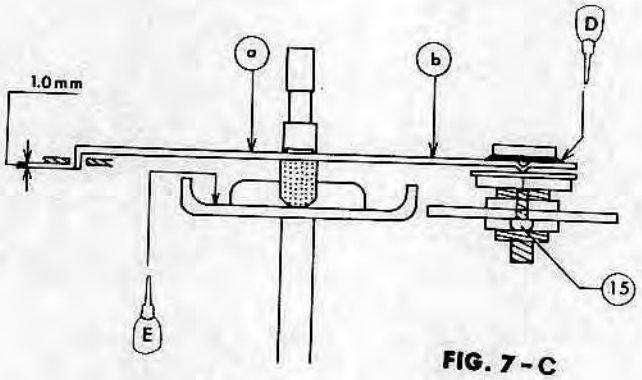


FIG. 7-C

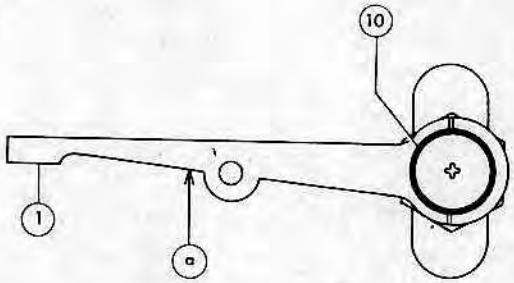


FIG. 7-A

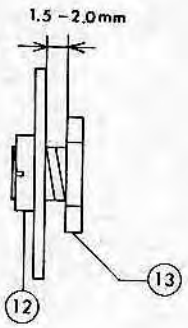


FIG. 7-B

C. Sending Claw Assembly (1) and Shutter (3) (Cont'd)

REASSEMBLY NOTES:

1. Replace the claw or pin if they are worn-out as shown in Fig. 7.
2. Attach the (13) with (12) to (14) in place where there is the clearance (1.5-2.0mm) as shown in Fig. 7-B. Use a tool P055.
3. Attach the claw to the (12)(13)(14) assembly with (11)(10)(9) after checking the claw is straight. Measure the spring pressure of (10) at the (a) point and in the (a) direction, using a scale C043. The proper pressure is at the range of 60 - 70g. If improper, adjust it with use of proper washer.
4. Attach the claw assembly to the machine frame.
5. Adjust the claw tip protrudent length from the aperture plate surface as follows.
   a. The length is 1.0mm (Fig. 7-C). The 1.0mm length is originally adjusted in assembling line with care, but if not 1.0mm, adjust the length by screwing or unscrewing the (13) in Fig. 7-B, using a gauge P047.
   b. When the length is 1.0mm, the claw pin contacts close to the bottom of the cam. If opens, bend the (b) point in Fig. 7-C.
   c. The two pieces of claw tip should protrude into the film perforations simultaneously.
6. Attach the (6)(7) in Fig. 6 and adjust their spring pressure as follows:
   a. Move the claw downward fully (position where claw ends to send the film) and measure the pressure at the (a) point in Fig. 7-C.
   b. The (7)'s pressure is within 900 $\pm$ 50g when you measuring in the direction that the claw transports the film. Use a scale P048.
   c. The (6)'s pressure is within 450 $\pm$ 50g when you measuring in the direction that the claw goes away from the aperture plate. Use a scale P026.

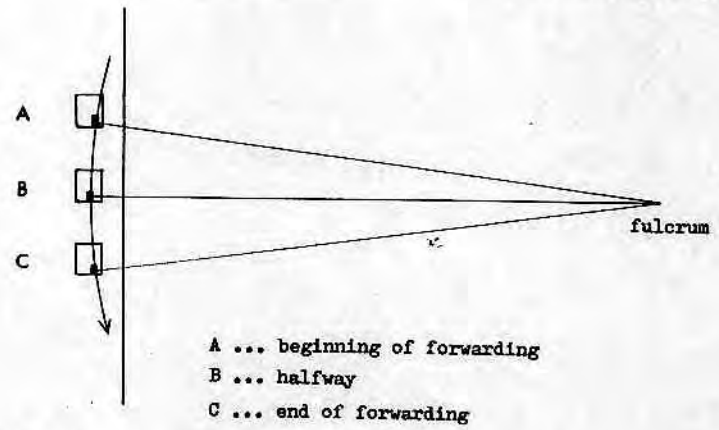


FIG. 8

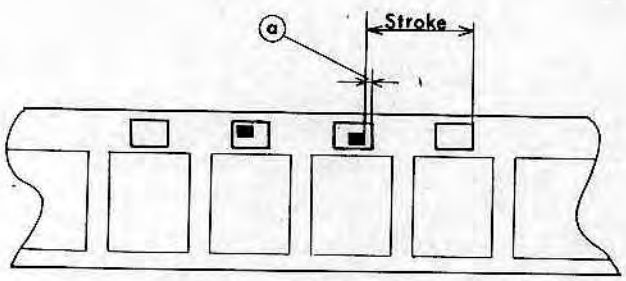
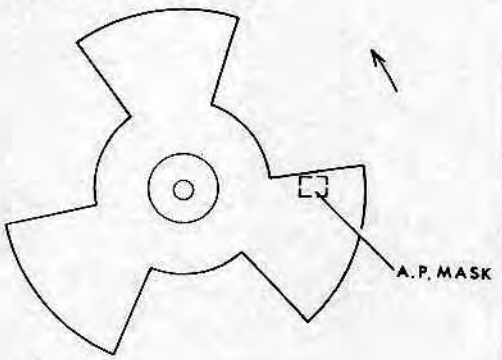


FIG. 9

beginning of forwarding



end of forwarding

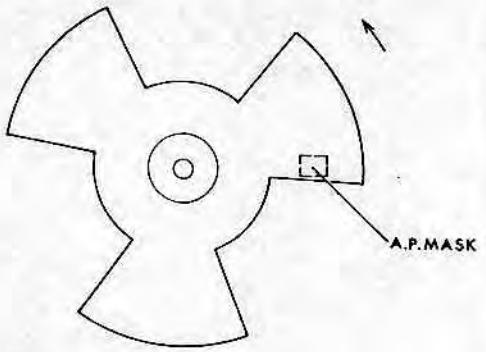


FIG. 10

C. Sending Claw Assembly (1) and Shutter (3) (Cont'd)

REASSEMBLY NOTES (Cont'd)

7. Adjust the claw position as follows:

   Set a white leader film on the aperture plate. Whenever the claw tip just protrudes into the perforation, it shouldn't touch the perforation edge regardless a framing knob (Fig. 6-16) position. This is applied to both of forward and reverse projections. For this adjustment, shift the claw position with (15)x2 in Fig. 7-C. Refer to Fig. 8.

8. Check the claw stroke.

   As sending the film of one or two frames by hand, make sure that there is a slight clearance (Fig. 9-a) between the claw tip and perforation just before the tip transports the film, and that the claw tip doesn't scratch the perforation edge when putting back.

9. Attach the shutter.

   a. Make sure that oil doesn't adhere to the (3)'s pulley in Fig. 6.

   b. Adjust the shutter position so that it shades the aperture mask while the claw transports the film of one frame. Refer to Fig. 10.

10. Adjust the framing.

    Attach the machine frame to the body. Project the resolving power film (P054). Measure the width between the aperture mask upper line and picture bottom line appearing when the framing knob is turned fully clockwise. Memorize this width. Next measure the width between the mask bottom line and picture upper line appearing when the knob is turned fully counterclockwise.
    The former width and the later should be in ratio of 6:4.
    If not, adjust the (17) position in Fig. 6.

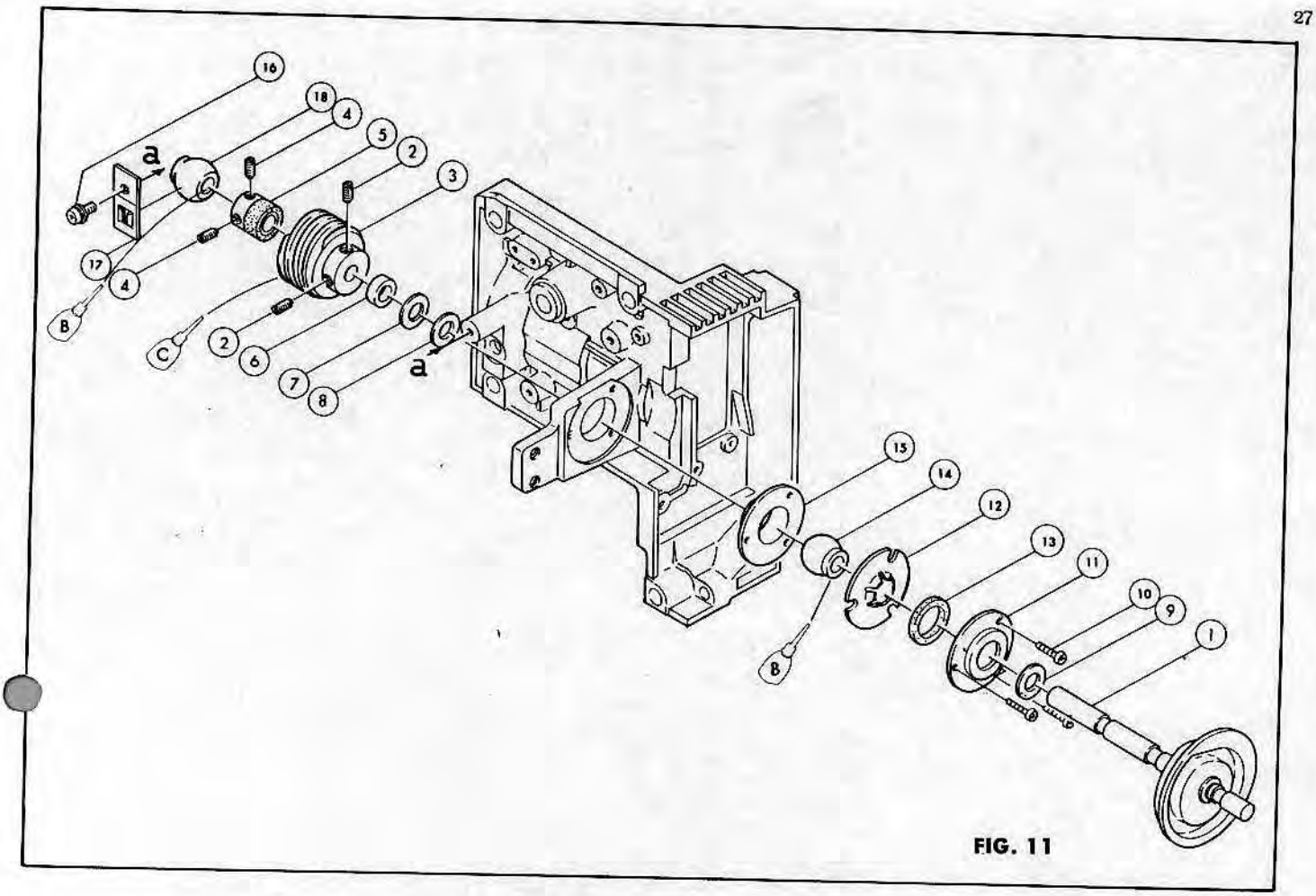


FIG. 11

D. Cam Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 11)

Unstable picture (up/downward)	There is a play among the (1) and (14)(18) owing to abrasion in the direction of its shaft. The (1)'s stroke is insufficient.
Film flow	
Running noise	Flaw on the (1)'s cam surface.
Wow/Flutter	Flaws on the (1)(3). The (1) turns irregularly owing to eccentricity of the (14)(18).
Slow projection speed	Oil, which is lubricated among (1) and (14)(18), becomes insufficient.
ESS sync is defective	The (5) is defective or out of position.

DISASSEMBLY:

1. Pull out the (1) after loosening the (2)x2, (4)x2. The parts from (3) to (9) will fall off. Take care not to mar the (3) with flaw and not to put oil on.

2. Unscrew the (10)x3 and remove the (11)(12)(13)(14)(15). You, however, had better not take off the (11) because its center gets out of position, except unavoidable case. The (13) of 0.3mm (2 pcs.) or 0.5mm (1 pce.) thick is used.

3. Unscrew the (16) and remove the (17)(18).

REASSEMBLY NOTES:

1. Make sure that the cam surface and its shaft have no flaws.

2. After checking there is no play among the (1) and (14)(18), attach the (14)(18) to the machine frame. Adjust the (1)'s turn by changing the (18) position to see that the (1) can turn smoothly without unevenness.

3. Attach the (1)(9)(8)(7)(6)(3)(5) to the machine frame simultaneously.

4. Adjust the (3)'s position with the (2)x2 so that the (1) can turn smoothly without rattling and unevenness in the direction of the (1)'s shaft.

5. For further assembling works, refer to Page 22.

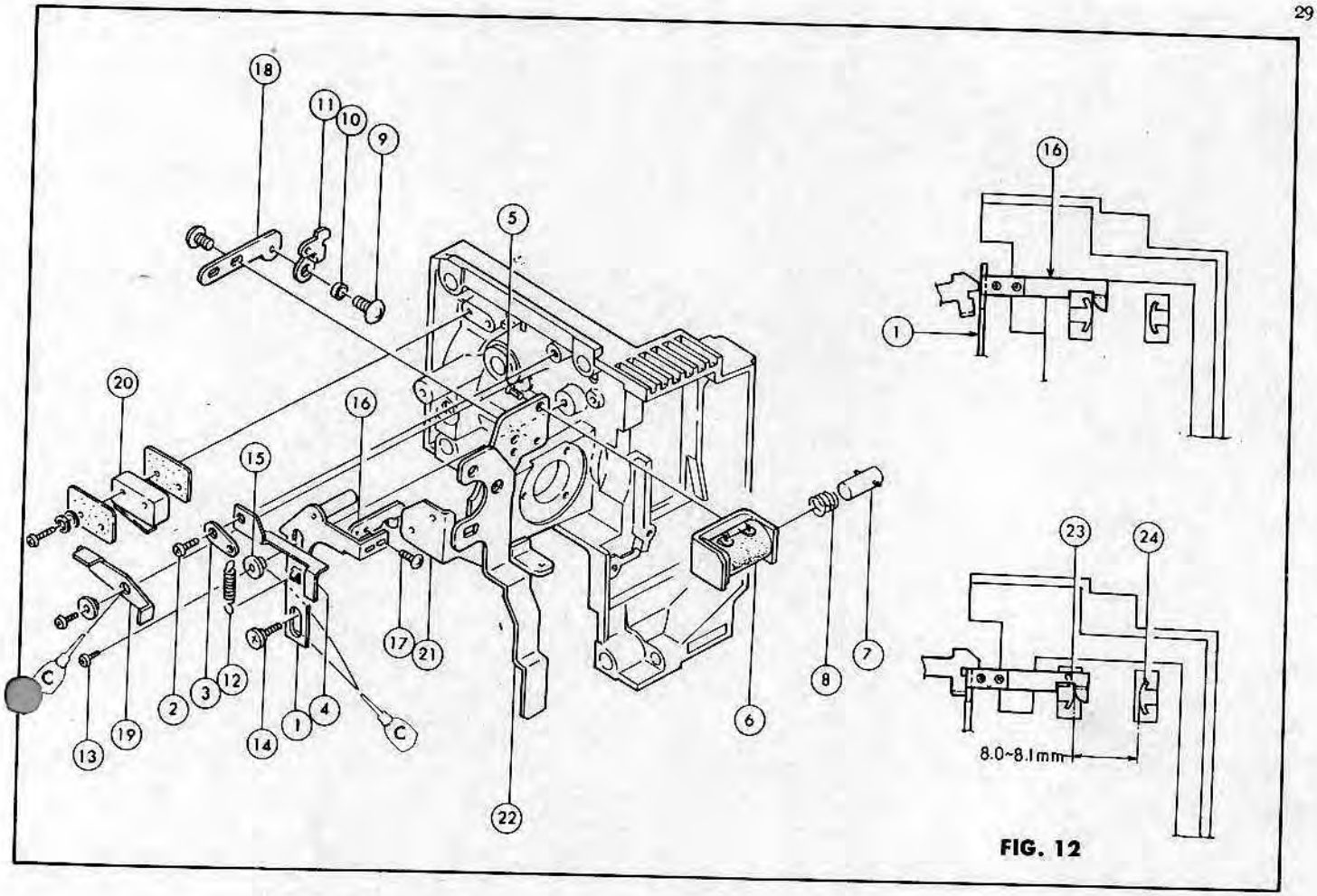


FIG. 12

E. Auto-Threading Mechanism

TROUBLESHOOTING: (Refer to Fig. 12)

Unable to set to auto-threading condition	The (6)'s defective. The (1)(11) are malfunction or out of position.
Unable to set back from auto-threading	The (1)(19) malfunction. The (6)(20) are defective. The (11) is out of position.
Film is interrupted in auto-threading	The (16) is out of position.
Unstable picture (right/leftward)	The (16) malfunctions.

DISASSEMBLY:

1. Take off the (3)(4) after unscrewing the (2). Note that the (12) may fly off.
2. Take off the (6) after unscrewing the (5)x2. The (7)(8) will fall off.
3. Take off the (11) after unscrewing the (9). The (10) will fall off.
4. Take off the (1) after unscrewing the (13)(14). The (15) will fall off.
5. For further disassembly, refer to Fig. 12. You had better not disassemble the (18)(21)(22) because a frame line gets entirely out of order except unavoidable case.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each lever operates firmly.
3. When you push the (23) down for auto-threading, the (16) pushes the (23) down. Under this condition, the space between the (23) and (24) should be within 8 - 8.1mm as shown in Fig. 12. For this adjustment, change the (16)'s position.

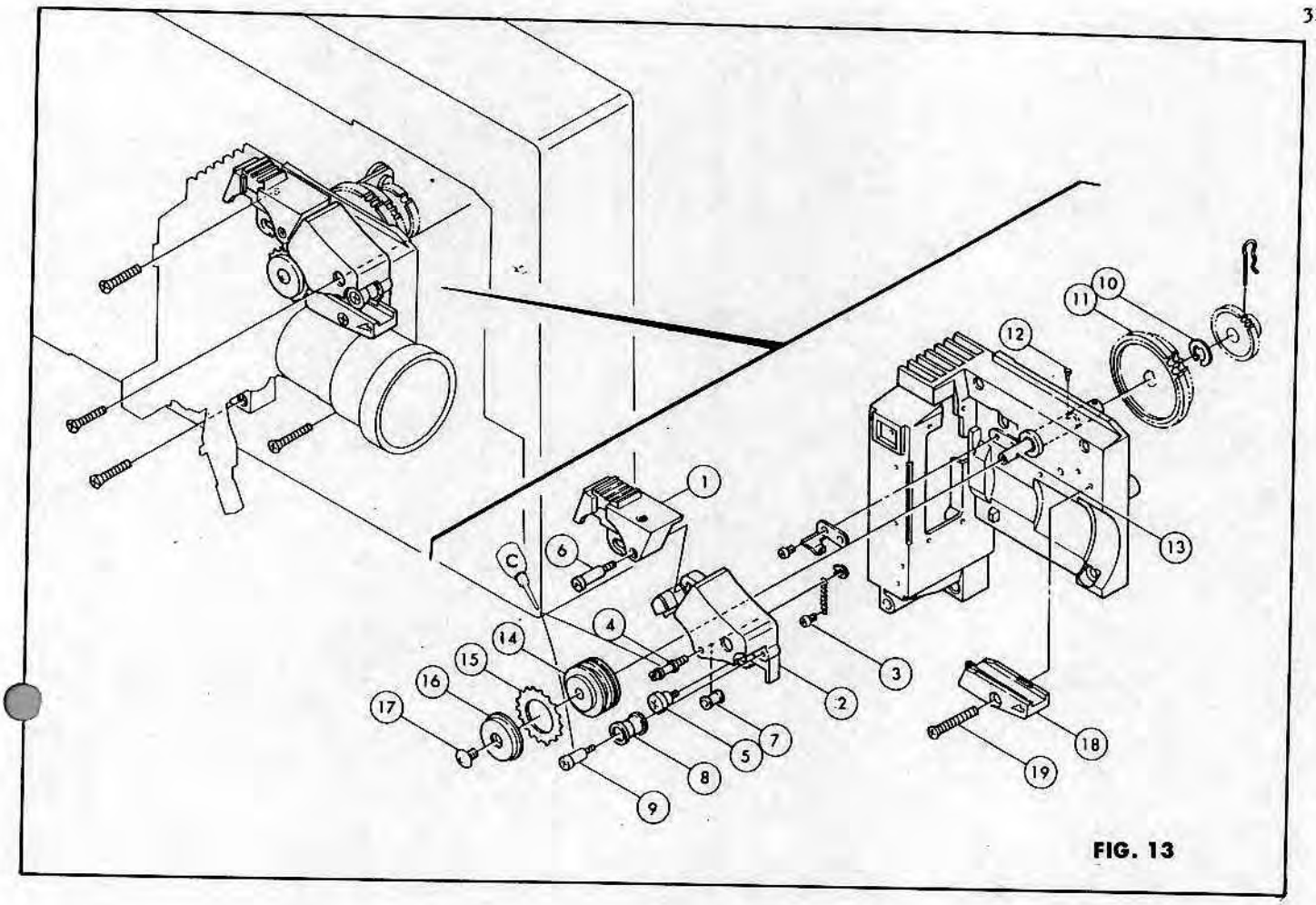


FIG. 13

F. First Sprocket Shoe (2)
First Sprocket (15)
First Sprocket Gear (11)
Threading Button (1)

TROUBLESHOOTING: (Refer to Fig. 13)

Film scratch	The (15) has flaw or burrs. The (7)(8)(14) have flaw or turn irregularly.
Wow/Flutter	The (11)(15) are defective. The (12) has fallen off.
First sprocket doesn't turn	The (11)'s defective. The (12) has fallen off.
Upper loop decreases in reverse projection	The (2) is not fixed firmly. Stop the (2)'s rattling with use of proper washer.

DISASSEMBLY:

1. Take off the (19)(18)(3)(5)(2) in this order. Don't remove the (6) except unavoidable case.
2. Pull out the (13)(14)(15)(16)(17) as an assembled parts toward you. In an improved machine, however, the (13) is modified and you cannot pull it out. Take off the (14)(15)(16) after unscrewing the (17) and then push the (13) backwards.

REASSEMBLY NOTES:

1. Fix the (14)(15)(16) with (17) to the (13).
2. Fix the (8) with (9) to the (2). Make sure that the (8) turns smoothly and has no flaw and dust.
3. Fix the (7) with (4) to the (2). Make sure that the (7) turns smoothly and has no flaw and dust.
4. Fix the (2)(18) with (5)(19) respectively.

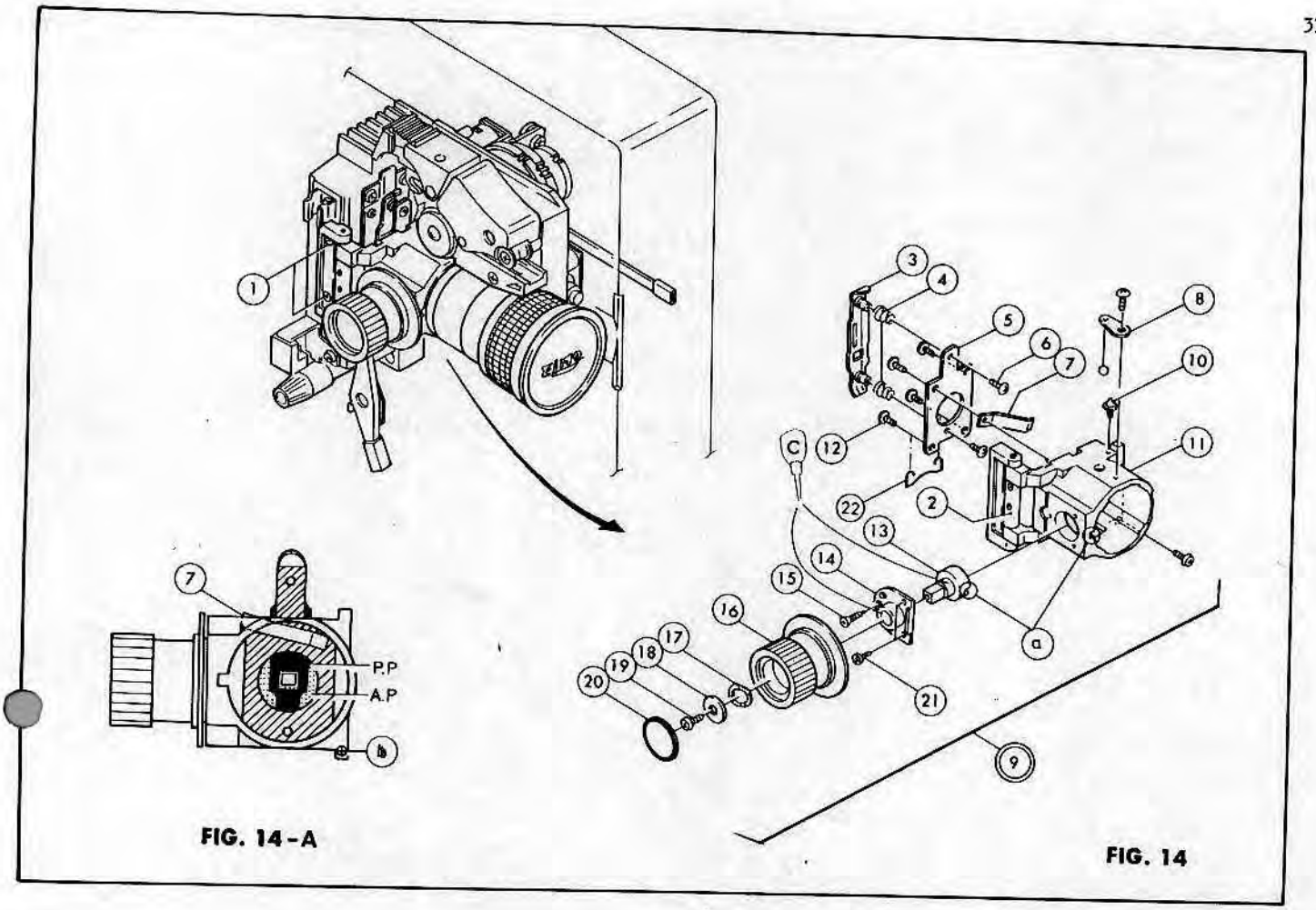


FIG. 14-A

FIG. 14

G. Projection Lens Holder Assembly ((9))

TROUBLESHOOTING: (Refer to Fig. 14)

Film scratch	Flaws, burrs or dust on the (13). The (4) pressure is excessive.
Picture sometimes becomes out of focus	The (3) is distortional.
Unstable picture	The (4) pressure is insufficient. Its proper pressure is within 65 ± 5g.
Upper loop is lost during optical film playback in reverse projection	
Uneven focus	The ((9)) is out of position.

DISASSEMBLY:

1. Remove the (1)x2 and detach the ((9)) from the machine frame. Don't detach it except unavoidable case.
2. For further disassembly, refer to Fig. 14. The (20) is adhered with double tack tape.

REASSEMBLY NOTES:

1. Attach the (3)(4) to the (5) with (6)x2.
2. Attach the above assembly and the (7) to the (11) with (12)x4 tentatively. Refer to Fig. 14-A to attach the (7).
3. Attach the (14) to the (11) with (21)x2 and (15). Don't misplace the (15) and (21).
4. Attach the (16)(17)(18) to the (13) with (19). Attaching position of the (16) is where the notches (a) of (11)(13) coincides with each other when you turn the (16) fully clockwise.
5. Attach ((9)) to the machine frame with (1)x2. Adjust and tighten the position of the (3)(4)(5)(7) being assembled tentatively so that PP mask can be in the ratio of 4:6 above and below against AP mask. Refer to Fig. 14-A. Adjust it fine by changing the position of the (2).
6. After attaching the machine frame assembly to the base frame, load the resolving power film type S (P054) and run. Make sure the picture is in focus at the all points. If not, adjust it as follows:
   In case upper or lower part is out of focus, adjust it with (1).
   In case right or left part is out of focus, adjust it with (b).

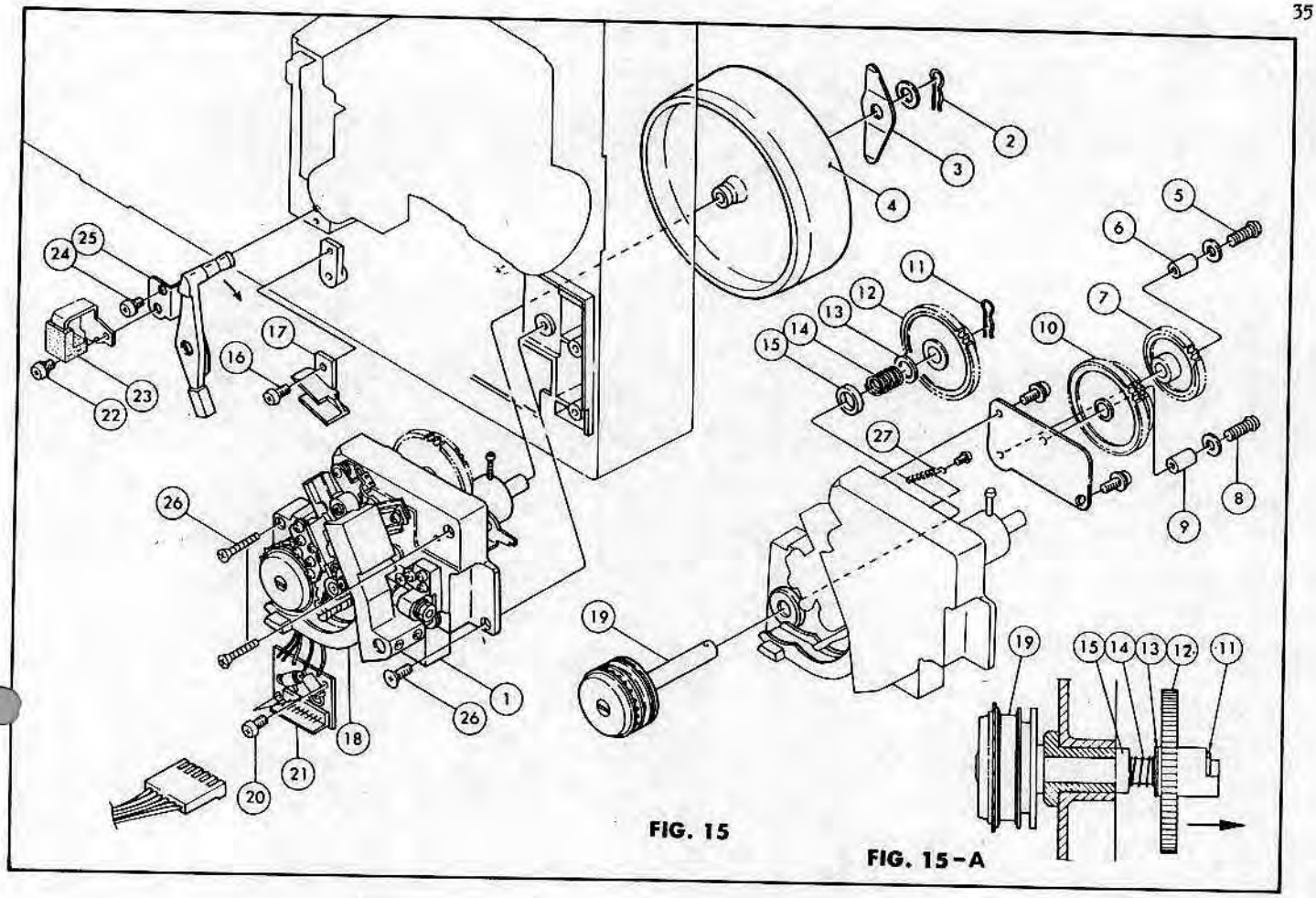


FIG. 15

FIG. 15-A

3. SOUND HEAD FRAME SECTION

A. Sound Frame (1)

TROUBLESHOOTING: (Refer to Fig. 15)

Wow/Flutter	Attaching position of (1)(7)(10)(12) are incorrect. Flaw, deformation or uneven running of (7)(10)(12). Flaw or eccentricity of the (19).
Film scratch	Flaw on the (19).
Malfunction of loop-setter	The (25) is out of position. Attach the (25) while depressing it in the arrow direction.
Front cover doesn't close	

DISASSEMBLY:

1. Remove the exciter lamp. Refer to Page 54 for reattaching it.
2. Remove the drive flywheel spring (Fig. 23-3) from "a" point and 'Solenoid I Spring I' (Fig. 23-7) from b point. Then disassemble the parts by following the order of number in Fig. 15.
3. Remove the (17)(11). Then pull out the (19) while depressing the (18) downward and holding the (13).
4. Don't touch the cancel coil attached to the (21) in disassembling work.
5. Take care for handling of (1)(7)(10)(12)(19).

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that (1)(7)(10)(12)(19) have neither flaw nor dust on their surfaces.
3. Attach the (1) with (26)x3 tentatively. Then fix it after adjusting each backlash of (7)(10)(12).
4. After attaching the (12), pull it in the arrow direction.
5. When detaching sound frame with the above procedures, check spring pressure of the head presser (Fig. 17-10 on Page 40), position of the head presser (Fig. 23-1 on Page 48) and position of switch ON (Fig. 23-A on Page 48).
6. After completing the assembly work, make sure of no hum. For this adjustment, change the position of the cancel coil.

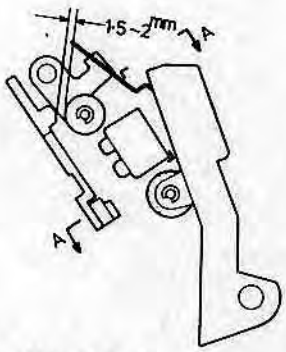


FIG. 16-A

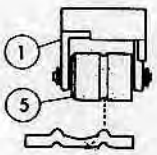
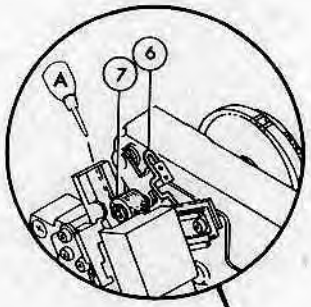


FIG. 16-B



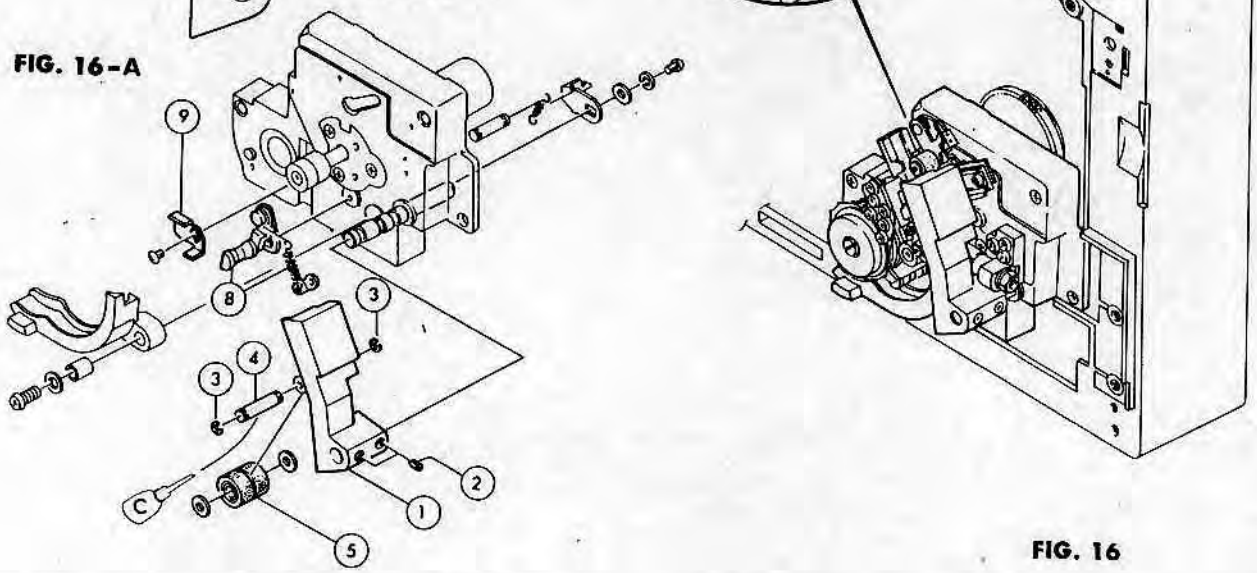


FIG. 16

B. Pad Roller Lever (1)

TROUBLESHOOTING: (Refer to Fig. 16)

Wow/Flutter	Flaw or uneven rotation of the (5)(7). The (1) is out of position or its spring pressure is improper. The (6)(8)'s spring pressure are improper.	Page 46
Wow/Flutter during only optical film playback	The (9) is out of position.	
Film removing from film path is not easy	The (1) is out of position.	
Film scratch	The (6)'s spring pressure is excessive.	Page 46
Slow sound picking-up	The (1)(6)'s spring pressure are insufficient.	Page 46
Lower film loop is hardly formed during optical playback		

DISASSEMBLY:

Remove the (1) by unscrewing the (2)x2. For further disassembly, refer to Fig. 16.

REASSEMBLY NOTES:

1. Check the (5)'s surface -- flaw or oil. Attach the (5) to (1). The (5) should turn smoothly. Stop a play in the (5)'s shaft direction within 0.1mm by insertion of proper washer. Fix the E-ring with "Screw-Lock".
2. Attach the (1) in place, making the space (1.5-2.0mm) as shown in Fig. 16-A and coinciding a protrusion of the head guide with the (5)'s groove (Fig. 16-B). The (1)(5) shouldn't contact the sound lens during STILL projection and the (5) shouldn't touch the solar battery during FWD projection.
3. The (7) should rotates smoothly and have no flaw and no oil.
4. The (9) is a stopper used for only optical film playback and has no respect to magnetic playback. The (8) shouldn't work during optical playback. For this adjustment, change the (9) position. Then check wow and flutter with optical test film.

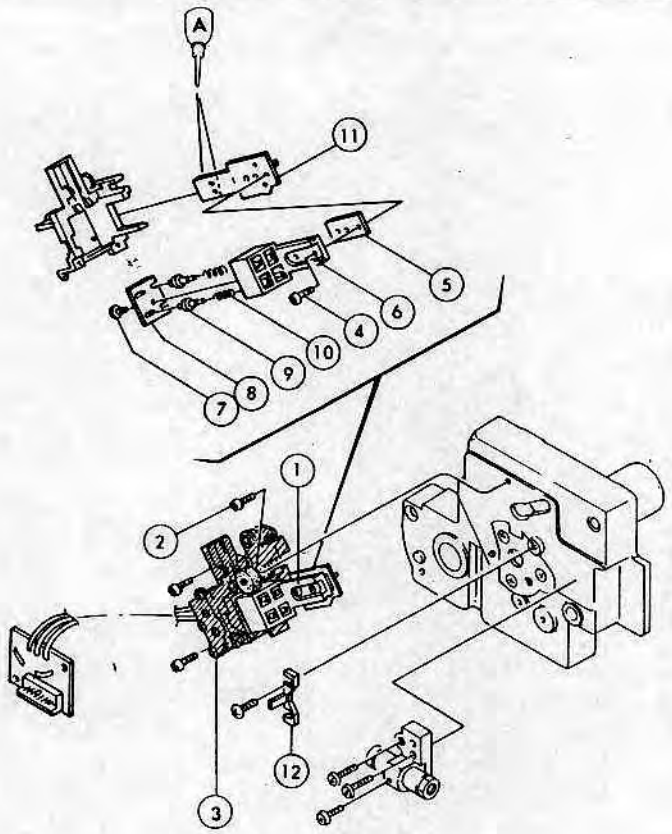


FIG. 17

C. Head Presser Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 17)

Magnetic recording/playback/erasing are faulty.	The (9)'s malfunction.
Film scratch	The (9) are defective.
Poor sound quality on optical playback	The (12) is defective or out of position.
Wow/Flutter, Low output level	The (10)'s pressure are insufficient.

DISASSEMBLY:

1. Detach a pad roller lever (Fig. 16-1).
2. Unscrew the (4)x2 and detach the (6) as an assembled parts. The (5) will fall off.
   In case of removing the (6) together with the (11), unscrew the (2)x3 and take off the (3) after removing the spring (Fig. 15-27) on back of the (11).
3. For further disassembly, refer to Fig. 17.

REASSEMBLY NOTES:

1. Make sure that the (9)'s have neither flaw nor burrs on film pressing surface.
2. After attaching the parts from the (7) through the (10) to (6), make sure that the (9)'s work smoothly.
3. The (10)'s pressure should be within 20-30g. Use a scale C043. Refer to Page 45.
4. Make sure that the (1) moves smoothly and that each (9)'s tip contacts with a head surface securely when removing the (3).
5. Depress the (1) in the arrow direction and the (9) will touch to a head surface.
   Further, depress the (1), and you should observe that the (9)x4 are pushed in by approx. 1mm.
6. Attach the (12) away about 0.1 - 0.2mm from a capstan axis.

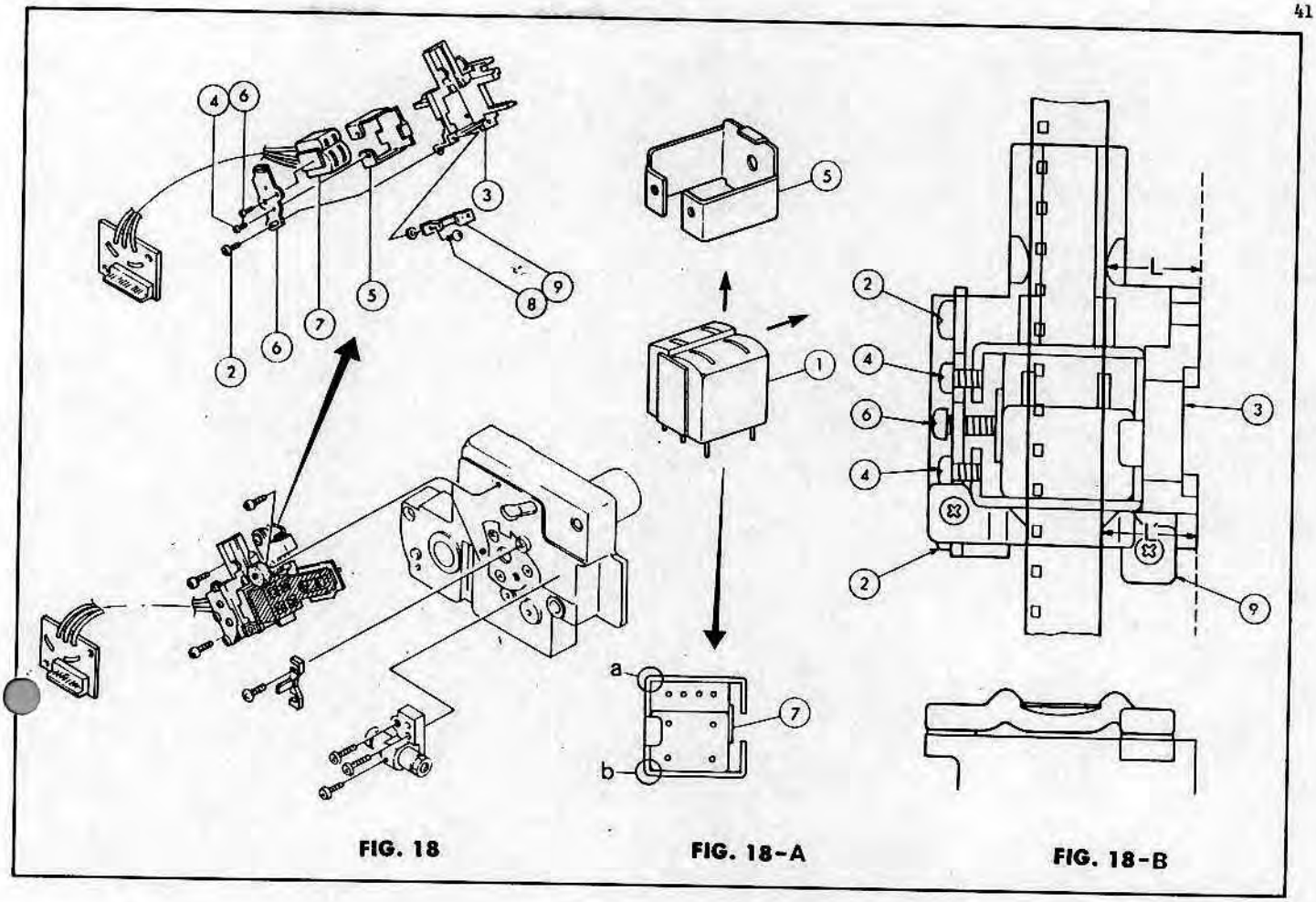


FIG. 18 FIG. 18-A FIG. 18-B

D. Combination Head (1)

TROUBLESHOOTING: (Refer to Fig. 18)

Magnetic recording/playback/erasing are faulty	The (1) is defective.
Wow/Flutter, Low output level	The (1) is worn-out or out of position. The (9) is out of position.
Film scratch	The (3) is defective. The (9) is out of position.
Film stops in auto-threading	The (9) is out of position.

DISASSEMBLY:

1. Unscrew the (2)x2, (4)x2 and disassemble the (1)(3)(5). The (1)(5) are assembled with "Cemedine 575".
2. When replacing the (1), unsolder the seven wires from the (1). Refer to Fig. 19.
3. For further disassembly, refer to Fig. 18.

REASSEMBLY NOTES:

1. Put the (1) in the (5) and fix them by applying "Cemedine 575" to 'a' point and "Alone Alpha" to 'b' point while pushing the (1) in the arrow direction.
2. Attach the (7) to the (1) with "Cemedine 575" as shown in Fig. 18-A.
3. Insert a conventional washer 2.5mm between the (3) & (9) and fix them tentatively. After making sure that distance L equals to L' with a vernier calipers, tighten the (9). Refer to Fig. 18-B.
4. Assemble the parts from (1) through (5) to the (3), and put the film as shown in Fig. 18-B. Adjust the position of the (1) with screws (2)(4)(6), aligning the two head gaps with magnetic stripes. Tighten the (2)(4).

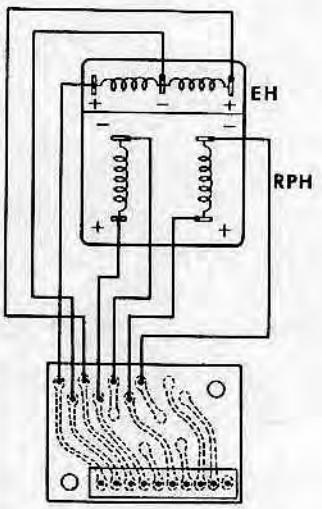


FIG. 19

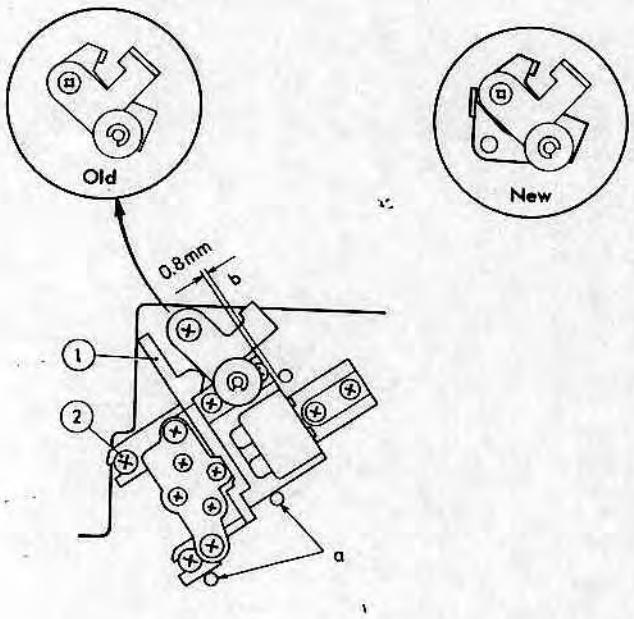


FIG. 20

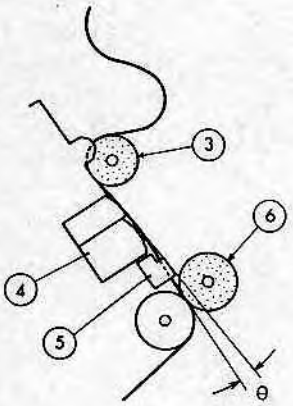


FIG. 21

E. Head Holder (1)

ATTACHING: (Refer to Fig. 20 & 21)

1. Put the (1) on the sound frame as shown in Fig. 20.
   Then fix the (1) tentatively with (2)x3 in place where the (1) not only contacts with 'a' points but is away by 0.8mm from 'b' point.

2. Adjust the head position so that the film runs straightly from (3) toward (4).

3. Locate the (1) as shown in Fig. 21 and tighten it.
   Fig. 21 shows the film should pass not along the extention line but away from the line by 0°.
   The film shouldn't touch the (5) except (5)'s side surface and the (6) shouldn't touch the (5).

IMPROVEMENT INFORMATION

Improvement of Machine Frame Assembly will be performed as under:

Trouble	Countermeasure
If the film is incorrectly spliced with a tape, the spliced part may be doubled when it reaches the place where the loop is to be formed, causing that the film stops on the way or that loop is getting shorter.	The pressure plate fixer (P/No.P413946: (22) on Page 33) is newly applied and the film presser assembly (P/No. 4P8GS0028) is replaced by the new one (P/No.4P8GS0028B). The (25) on Page 35 is attached more closely to the projection lens.
Unstable picture of new printed film	By attaching the film side presser stopper (P/No.P41395: (9) on Page 19), the movement of (5) is limited.

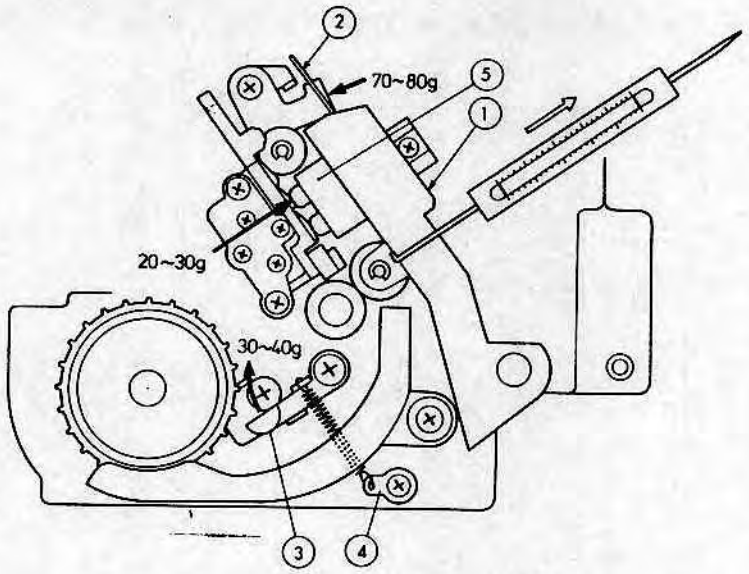


FIG. 22

F. Spring Pressure Adjustment

Adjust each spring pressure of film presser, pad roller and middle tension in order to decrease wow and flutter and to stabilize the optical sound playback.

1. Check the pressure of film presser spring (Fig. 22-2) while pushing it in the arrow direction with a scale C043. The measurement timing is moment the (2) goes just away from the (5).
   The range of 70-80g is optimum.
   For this adjustment, bend the (2). Make sure the (2) is not pushing the (5).

2. Check the pressure of pad roller lever (Fig. 22-1) while pulling it in the arrow direction with a scale P026.
   The measurement timing is moment the (1)'s roller goes just away from the capstan.
   The range of 250-300g is optimum.
   For this adjustment, change the position of the (2) in Fig. 23.

3. Check the pressure of middle tension (Fig. 22-3) while pushing it in the arrow direction with a scale C043.
   The range of 30-40g is optimum.
   For this adjustment, change the position of (4).

Notes:

1. The adjustment of pressure of film presser is effective for forming loop during optical film playback. The excessive pressure, however, may cause film scratch and wow.
2. The adjustment of pressure of pad roller affects sound picking up during recording or playback.
3. The adjustment of pressure of middle tension is not effective for decreasing large wow.

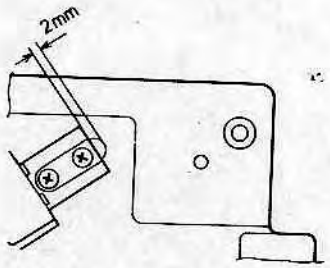


FIG. 23-A

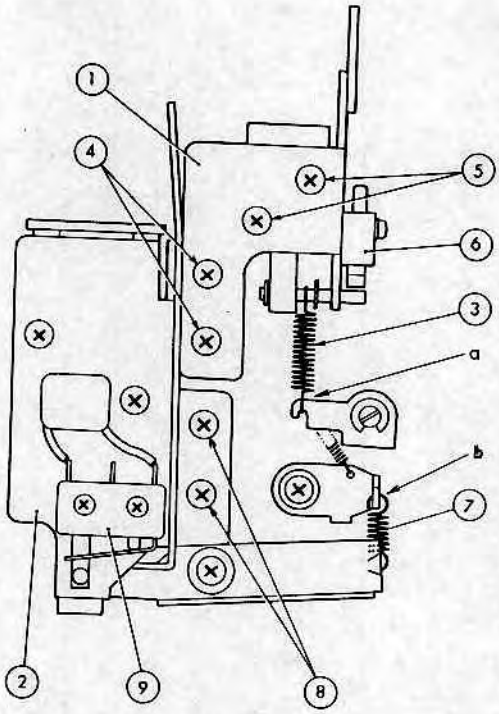


FIG. 23

G. Head Presser Solenoid (1) and Pad Roller Lever Solenoid (2)

TROUBLESHOOTING: (Refer to Fig. 23)

Wow/Flutter	The (1)(2) are out of position. The (3)(7)'s pressure is insufficient.	
Solenoids (1)(2) don't work	The (1)(2) burnt -- (the (6)(9) are out of position or defective). Trouble in the electric circuit.	Page 99

DISASSEMBLY:

1. To remove the (1), unhook the (3) from 'a' point and unscrew the (4)x2.
2. To remove the (2), after removing the (6) in Fig. 4, unhook the (7) from 'b' point and unscrew the (8)x2.

REASSEMBLY NOTES:

1. When attaching the (1), make a clearance of 2mm as shown in Fig. 23-A.
2. Make sure that the (6) can come ON whenever the solenoid (1) works.
3. Attach the (2) in place where the spring pressure of pad roller lever is within 250-300g (Refer to Page 46).
   Adjust the (9) position so that the (9) can come ON whenever the solenoid (2) works.
4. The (1)(2) will burn if the (6)(9) are out of position.
5. Take best care when handling the (3)(7).

H. Magnetic Sound Adjustment

1. Head Position Adjustment:

Test film ..... Pre-striped film recorded a 4KHz signal at 24 fps (P027).
Instruments ..... Distortion meter and resistor box 8 ohms 40W (P045).

Adjust the position in place where the output obtained from each track is maximum by loosening or tightening the (2)(4)(6).

2. Rated Output (both tracks 1 & 2): 10W (9V)
Maximum Output : 15W (11V)

Test film ..... Pre-striped film.
Instruments ..... Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

a. Record a 400Hz signal with 0 VU (controlled by AUX volume knob) at 18 fps.

b. Play back the signal with maximum volume. The output should be more than 11V. Readjust the head position if less than 11V.

H. Magnetic Sound Adjustment (Cont'd)

3. Distortion Factor (both tracks 1 & 2): less than 4%
S/N ratio (track 1) : less than -50dB) including weighting of -11dB
S/N ratio (track 2) : less than -45dB)

Test film ..... Pre-striped film.
Instruments ..... Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

a. Record a 400Hz signal with 0 VU (controlled by the AUX volume knob).

b. Play back the signal with 9V output (controlled by the main volume knob) and read the indication of the distortion meter set to distortion range. This shows distortion factor.

c. Stop the projector and remove the film with care to keep the volume position.

d. Run the projector again without film and read the indication of the distortion meter set to level range. This shows S/N ratio.

4. Cancel Coil Fine Adjustment (noise level): less than 20mV (both tracks 1 & 2) including weighting

Instruments ..... Distortion meter and resistor box 8 ohms 40W (P045).

a. Run the projector (motor switch ON, lamp switch ON, maximum volume) and adjust the cancel coil position, observing the indication of the meter.
When the indication is less than 20mV, the position is OK.

b. This adjustment is applicable to both tracks 1 & 2.

H. Magnetic Sound Adjustment (Cont'd)

5. Erasing Effect (both tracks 1 & 2): less than -40dB including weighting of -11dB.

Test Film ..... Pre-striped film.

Instruments ..... Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

a. Record a 400Hz signal with 0 VU (controlled by the AUX volume knob).
Rewind a part of recorded film and record no signal with minimum volume on the part, i.e. this work is erasing the 400Hz signal.

b. Play back a 400Hz signal with 9V output (controlled by the main volume knob) and when the part of no signal comes to the sound head, read the indication of the distortion meter set to level range.

6. Difference in output between tracks 1 & 2:

Test Film ..... Pre-striped film.

Instruments ..... Oscillator, distortion meter and resistor box (P045).

a. Record a 400Hz signal with 0 VU on each track.

b. Play back the signal with zero volume on each track.
Difference in output between them should be less than 4dB VU.
If not, readjust the head position.

H. Magnetic Sound Adjustment (Cont'd)

7. Sound Transfer from one track to another:

Test film ..... Pre-striped film.

Instrument ..... Oscillator.

a. Record a 400Hz signal with -6dB VU on track 1. Make sure of no oscillation when transferring the signal to track 2 with less than 0dB VU. Check up track 2 in the same manner as above.

b. If oscillation occurs while your transferring the signal to another track within 4dB VU, the sound head output is insufficient and therefore, readjust the head position.

8. Frequency Response:

Test film ..... Pre-striped film.

Instruments .... Oscillator, distortion meter and resistor box 8 ohms 40W (P045).

a. Record a 400Hz signal with 0 VU (controlled by AUX volume knob) at 18 fps and record a 2KHz signal without changing the AUX control knob position.

b. Play back the 400Hz signal with 0dB (controlled by main volume knob, observing the indication of distortion meter).
Play back the 2KHz signal without touching the knob and read the indication of the meter.
This indication should be between +2dB and -4dB.
Refer to the graph concerning other signals' tolerance.

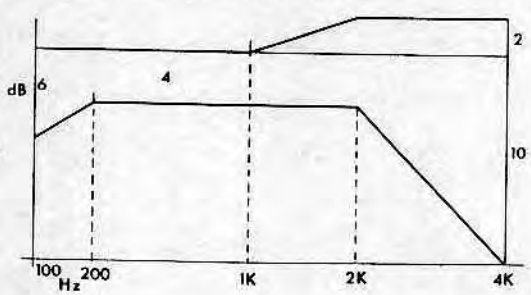


FIG. 24

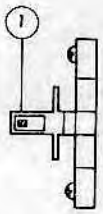


FIG. 25

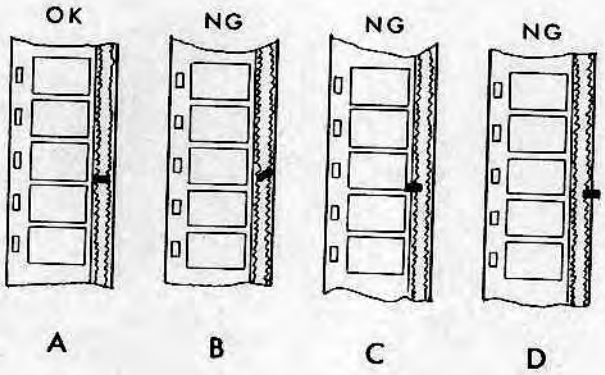


FIG. 26

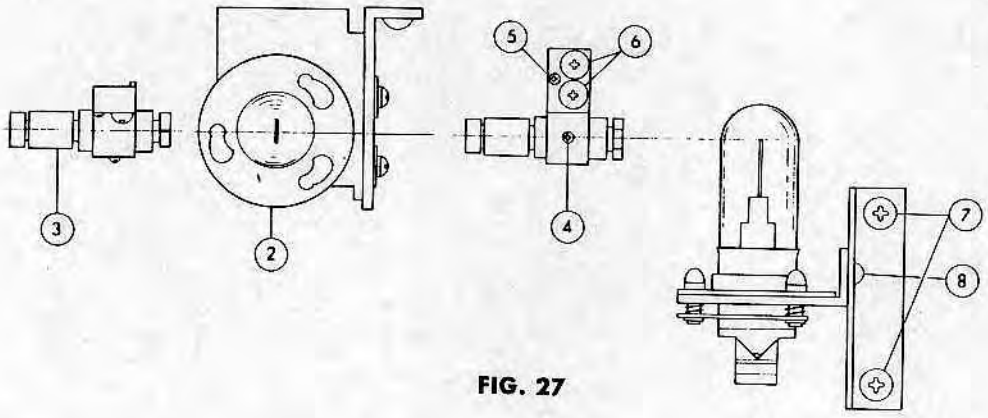


FIG. 27

I. Optical Sound Adjustment

TROUBLESHOOTING: (Refer to Figs. 25, 26 & 27)

Unable to play back optical sound	The (2)'s light does not come correctly to the (1). Defect of (1).
Unable to play back high frequency range	Improper position of the (3) as shown in Fig. 26(B). Stain on (3).
Played back the sound of poor quality	The (3) is out of position as shown in Fig. 26(C)(D).
Insufficient volume during optical playback	
Noise during optical playback	

1. Position Adjustment of Solar Battery, Sound Lens and Exciter Lamp:

Test film ..... Pre-striped film recorded a 4KHz signal at 24 fps (P053).

Instrument ..... Resistor box 8 ohms 40W (P045)

a. Turn on the exciter lamp and adjust the position of sound lens tentatively by turning screws (5)(6) in Fig. 27 so as to have the focus of scanning beam on the (1) as shown in Fig. 25. The lens shouldn't touch the capstan.

b. Adjust the position of the exciter lamp with (7)(8) so that the lamp filament is aligned with light axis of the lens as shown in Fig. 27.

c. Run the projector with film and play back the signal with maximum volume. To obtain the maximum output, adjust the sound lens position by turning or sliding the lens back or forth after loosening the (4) and by tightening or loosening the (5)(6). Refer to Fig. 26(A).

I. Optical Sound Adjustment (Cont'd)

2. Rated Output : 10W (9V)
Maximum Output: 15W (11V)

Test film ..... Optical super-8 frequency response film 400Hz (P051).
Instruments ..... Distortion meter and resistor box 8 ohms 40W (P045).

Play back the signal with the maximum volume at 24 fps.
Make sure that the output is more than 11V.
If not, make readjustment on Page 54.

3. Distortion Factor: less than 4%
S/N Ratio : less than -45dB

Test film ..... Optical super-8 frequency response film 400Hz (P051).
Instruments ..... Distortion meter and resistor box 8 ohms 40W (P045).

a. Play back the signal with 9V (controlled by the main volume knob, observing the indication of the distortion meter) at 24 fps.
At this time read the indication of the meter set to distortion range.
This shows distortion factor.

b. Take off the film from the projector without changing the volume position.
Run the projector again without film and read the indication of the distortion meter set to lever range. This shows S/N ratio.

I. Optical Sound Adjustment (Cont'd)

4. Noise: less than 20mV including weighting

Instrument ..... Distortion meter.

Run the projector without film at 24 fps. With maximum volume read the indication of the distortion meter set to level range. Make sure that the output is less than 20mV.

5. Frequency Response:

Test films ..... Optical super-8 frequency response film 400Hz (P051 and 4KHz (P053).
Instrument ..... Distortion meter.

a. Splice both films. Project the film at 24 fps.

b. Play back the 400Hz signal with 3V (controlled by main volume knob).
Play back the 4KHz signal without changing the volume knob position and see the output indicated by the distortion meter.

This output should be within -15dB.

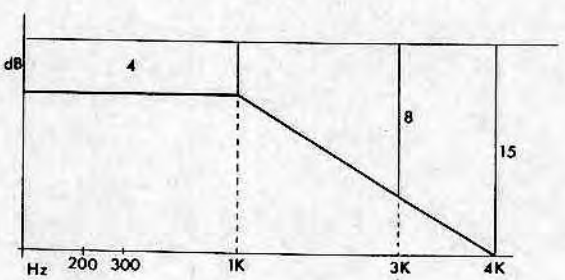


FIG. 28

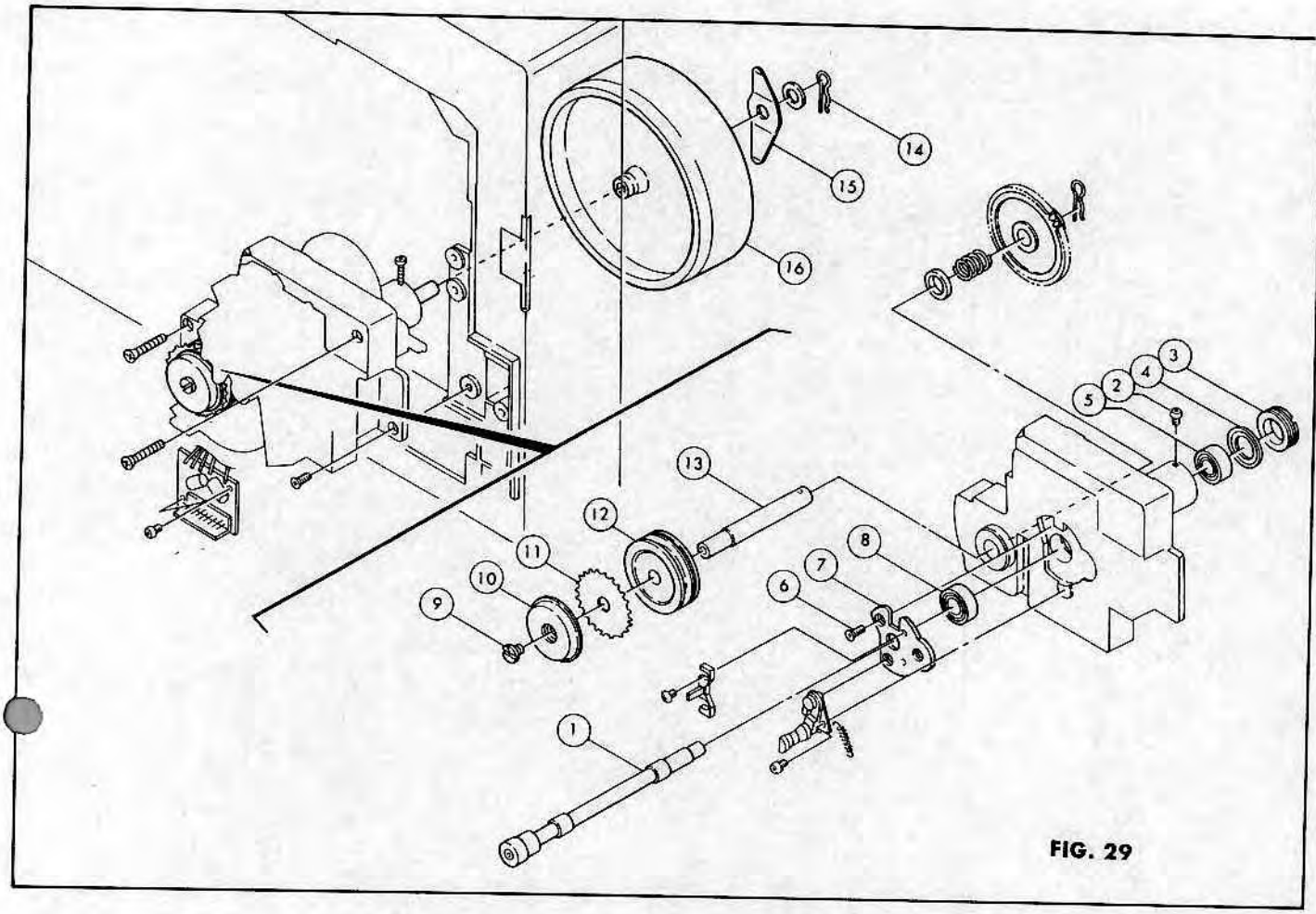


FIG. 29

J. Capstan (1) and Sprocket

TROUBLESHOOTING: (Refer to Fig. 29)

Wow/Flutter	Flaw, eccentricity and rattling in the shaft direction of the (1). Defect of the (5)(8). Excessive tightening of the (3). Flaw and eccentricity of the (11)(12)(13). Improper spring pressure of the (15). Improper balance of the (16).

DISASSEMBLY:

1. Remove the sound head holder (3) in Fig. 17.
2. Loosen the (2) and remove the (3) by turning it counterclockwise.
3. For further disassembly, refer to Fig. 29.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that the (1) turns smoothly without unevenness and rattling.

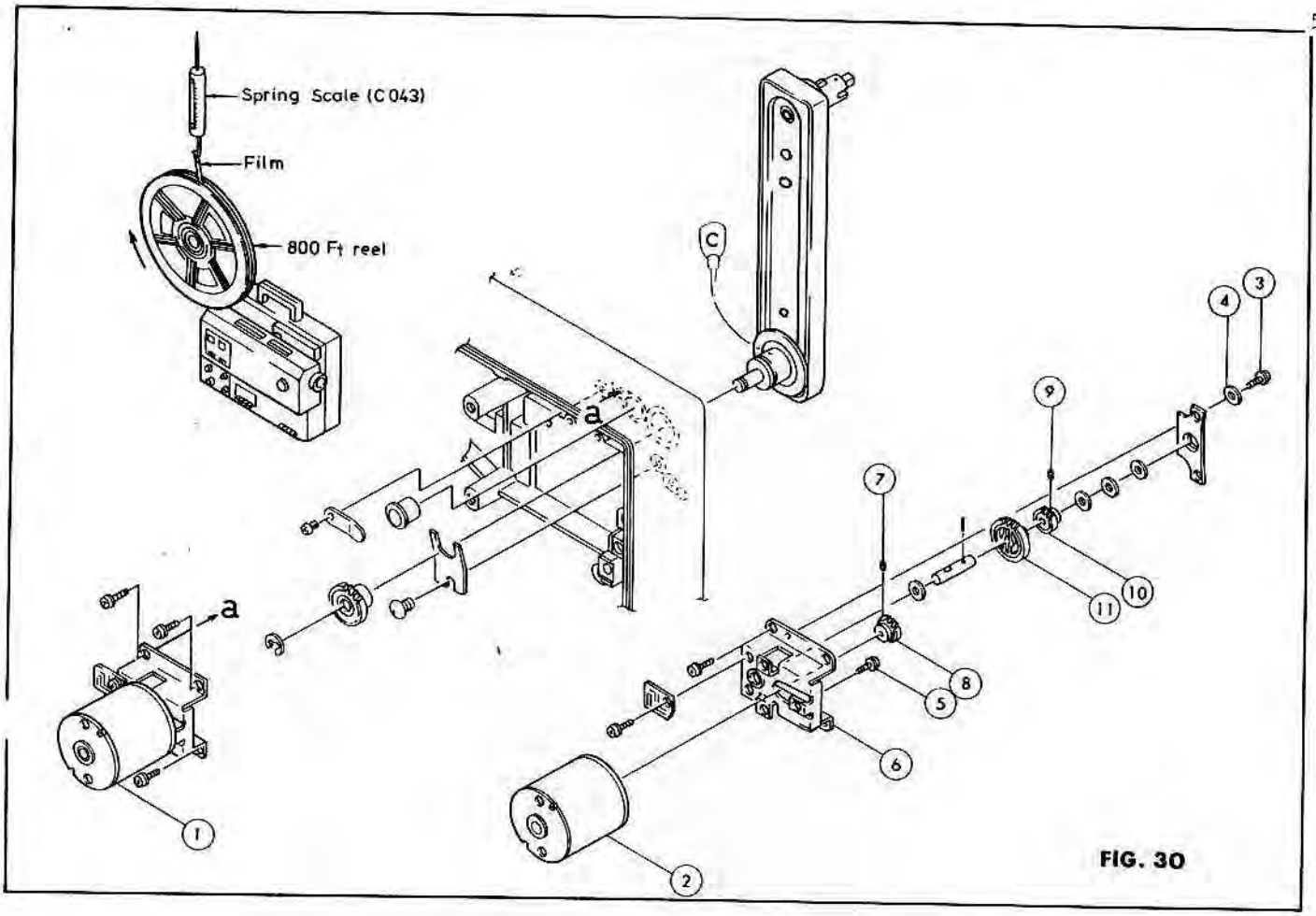


FIG. 30

4. TAKE-UP AND REWINDING SECTION

A. Take-up Motor Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 30)

Improper take-up function	Insufficient torque of the (2). Change the position of wire from 3V to 4V terminal on transformer.	Page 77
Take-up mechanism malfunctions entirely	Defect of the (2) or circuit trouble. Slip of the (8) or defect of gears (10)(11).	
Noise during forward projection	Improper engagement between (8) and (11). Defect of the (1) or its improper position.	

DISASSEMBLY:

Disassemble the parts in accordance with order of the reference number, referring to Fig. 30.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. The (1) should run by DC 4V with consumption current of under 140mA without any load. Use a DC stabilized power-supply C004 for check.
3. The (1) should be attached to the position where it runs by DC 4V with under 300mA current without any noise.
4. When the position of wire on transformer is changed, check and adjustment for rewinding is required. Refer to pages 64 and 66.
5. Take-up tension at 800ft reel core should be within 45 ± 5kg. Use a bar spring scale C043.
6. Since no slip-mechanism is applied, you adjust the take-up/rewinding power with supply voltage -- from 3V to 4V.

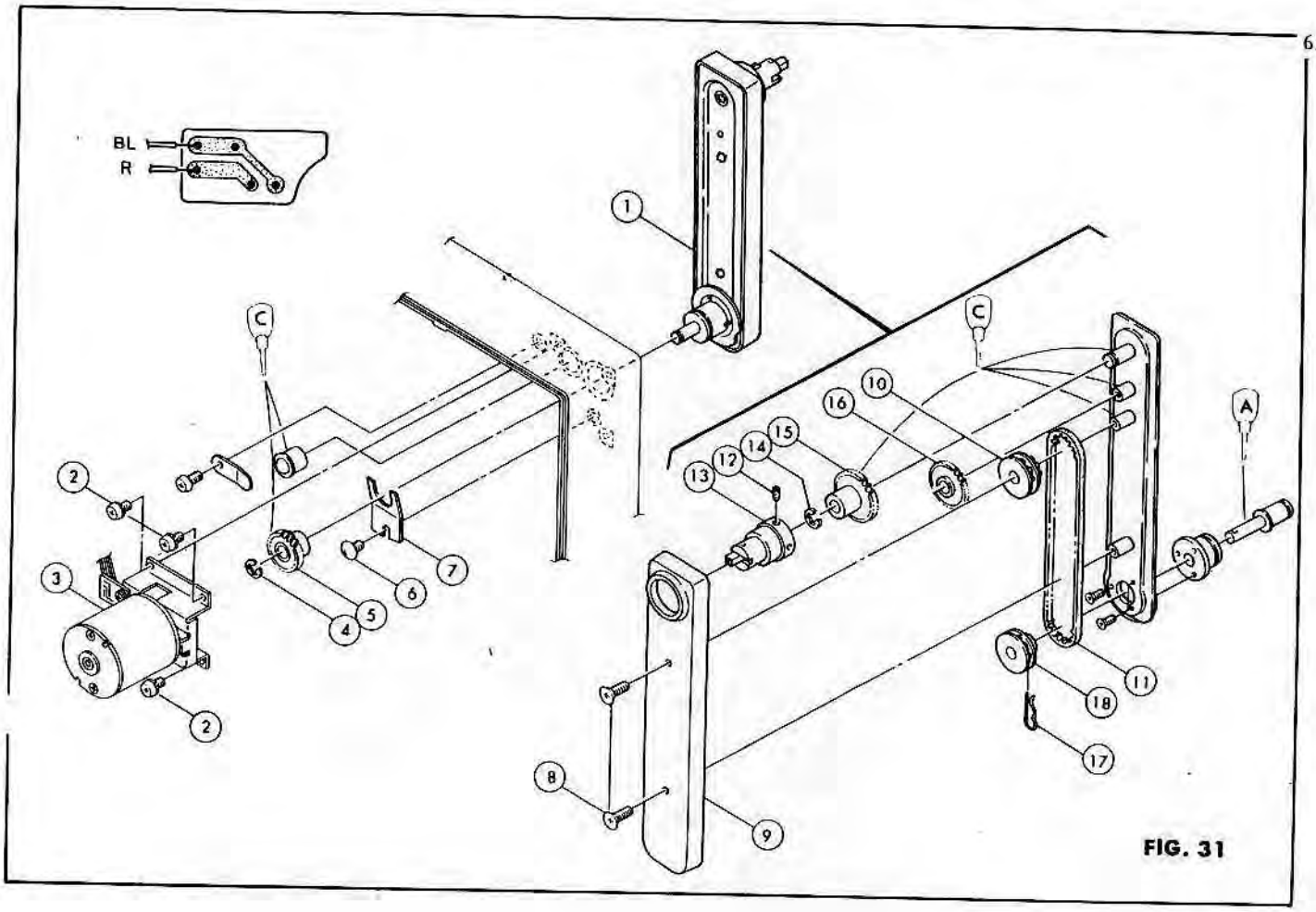


FIG. 31

B. Rear Arm (1)

TROUBLESHOOTING: (Refer to Fig. 31)

Take-up mechanism malfunctions	Defect of the (5)(10)(11)(18).
Noise	Lack of grease at the (10)(15)(16) and their shafts.

DISASSEMBLY:

1. When repairing the inside only of rear arm, unscrew the (8)x2 and remove the (9).
2. When detaching the whole rear arm, take off the transformer.
   (Refer to Page 78 -- need not unsolder the wires on it).
3. Unsolder the two wires, blue and red.
4. For further disassembly, refer to Fig. 31.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Apply the grease to all gears.
3. When tightening the (12)x2, align the screw holes of (13)(15) with each other.
4. After reassembly of the (1), make sure that it functions smoothly without unevenness.
5. The (5) can rotate in one direction only because the roller clutch is used in it.

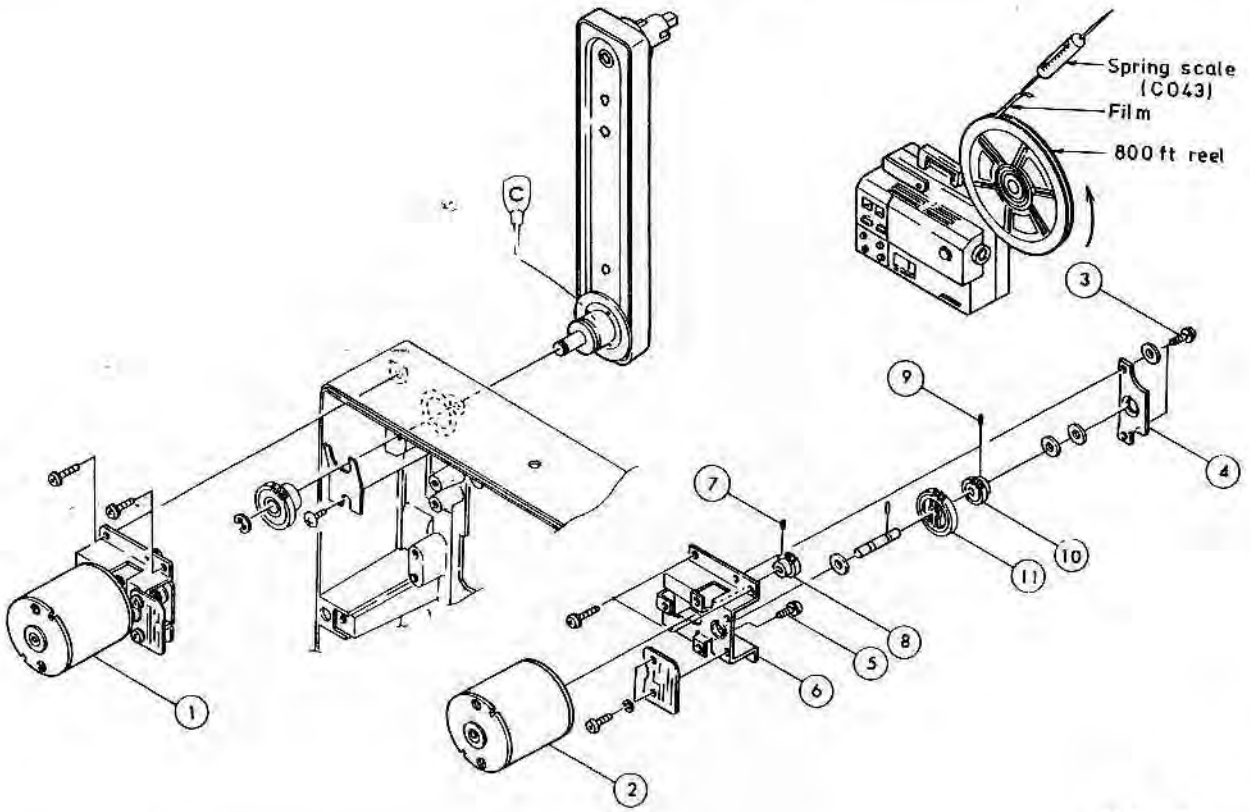


FIG. 32

C. Rewind Motor Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 32)

Film is wound loosely into feed reel in REV	The (1)'s torque is insufficient. Change the wire position from 3V to 4V terminal on transformer.
Upper loop is lost during REV projection	Excessive torque of the (1). Tighten the 1st sprocket shoe (Fig. 13-2) firmly. Attach the two diodes 1S1887 as shown in Fig. 33-A in order to lower the supply voltage.
Noise from the 1st sprocket in REV	
Noise during reverse projection	Improper engagement between (8) and (11). Improper position or defect of the (1).
Rewinding mechanism malfunctions entirely	Defect of the (2) or circuit trouble. Slip of the (8) or defect of the (10)(11).
Slow rewinding speed	Weak torque of the (1). Defect of the (2) or circuit trouble.
Rewinding mechanism stops on the way	

DISASSEMBLY:

1. Take off the transformer (Fig. 40-1) without unsoldering the wires.
2. Make disassembly procedures in accordance with order of the reference numbers in Fig. 32.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. The (1) should run by DC 4V with consumption current of under 140mA without any load. Use a DC stabilized power-supply C004 for check.
3. The (1) should be attached to the position where it runs by DC 4V with under 300mA current without any noise.
4. When the wire position on transformer is changed, check and adjustment for take-up is required. Refer to Page 60.
5. Take-up tension at 800ft reel core should be within 45 $\pm$ 5kg. Use a bar spring scale C043.
6. Since no slip-mechanism is applied, you adjust the take-up/rewinding power with supply voltage -- from 3V to 4V.

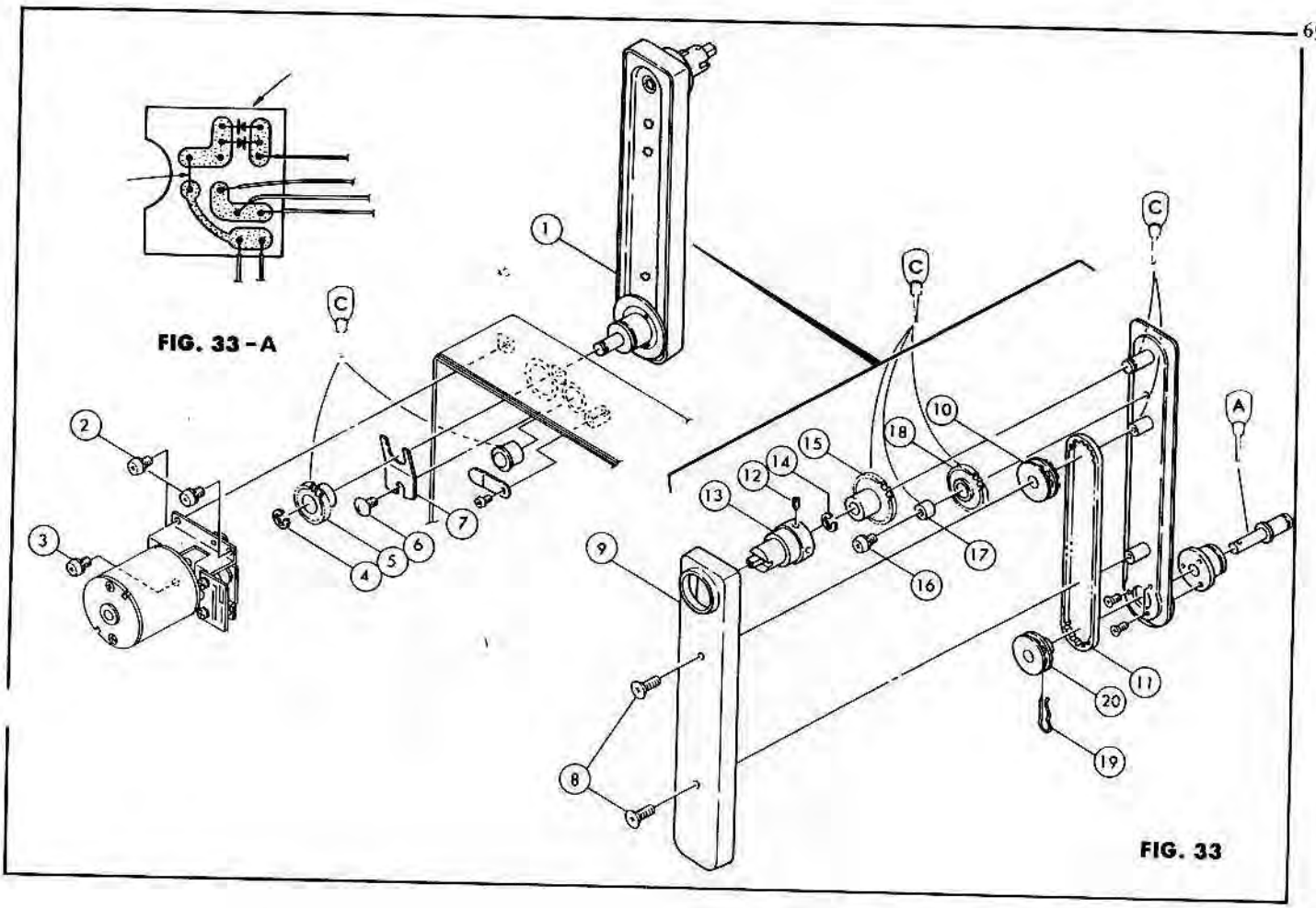


FIG. 33

D. Front Arm (1)

TROUBLESHOOTING: (Refer to Fig. 33)

Unable to rewind the film	Defect of the (5)(10)(11)(20).
Noise	Lack of grease at gears (10)(15)(18) and their shafts.

DISASSEMBLY:

1. When repairing the inside only of front arm, unscrew the (8)x2 and remove the (9).
2. When detaching the whole front arm, unsolder the two wires, blue and red.
3. For further disassembly, refer to Fig. 33.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Apply the grease to all gears.
3. When tightening the (12)x2, align the screw holes of (13)(15) with each other.
4. After reassembly of the (1), make sure that it functions smoothly without unevenness.
5. The (5) can rotate in one direction only because the roller clutch is used in it.

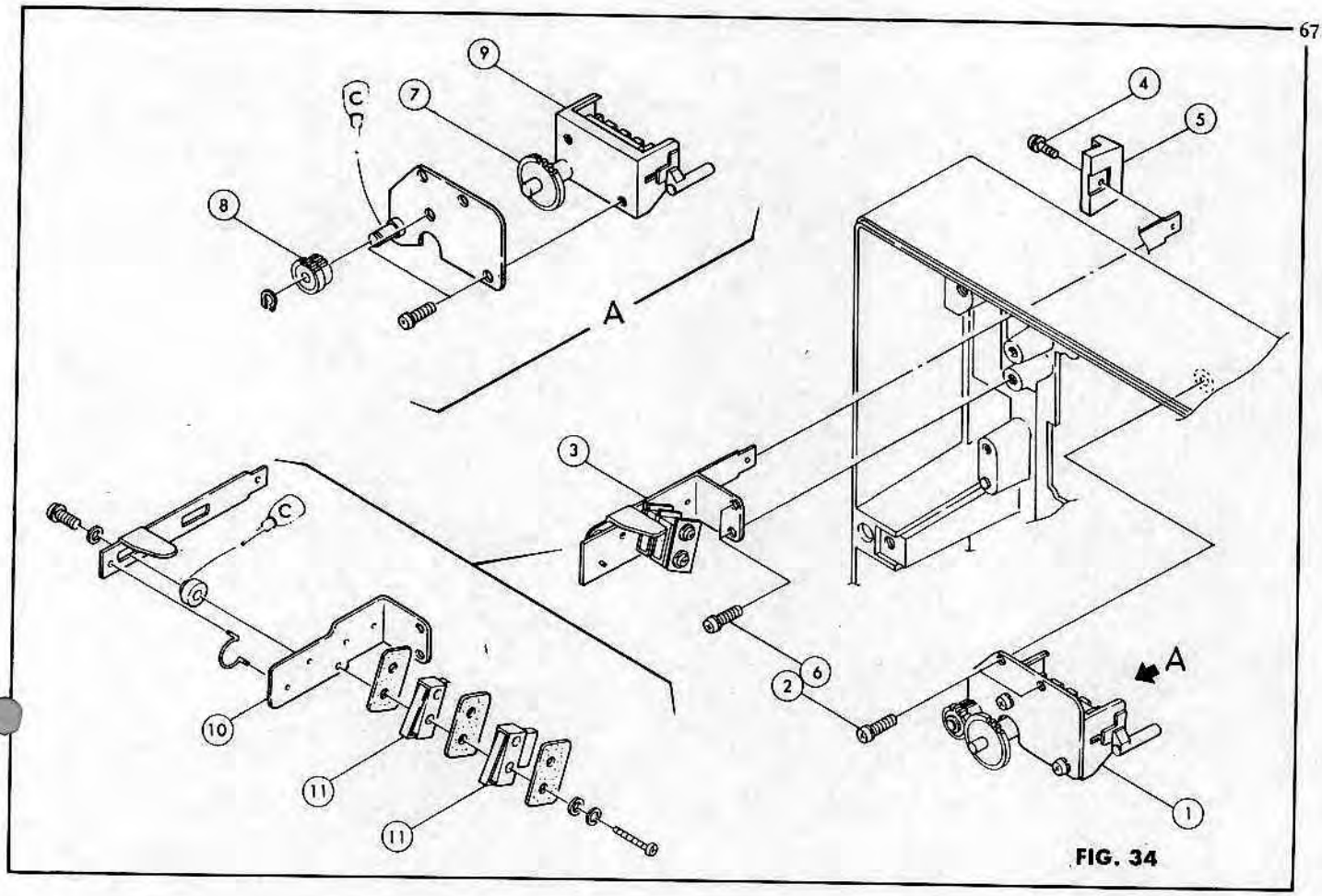


FIG. 34

5. BASE FRAME SECTION

A. Counter Gear (1) and Rewind Switch (3)

TROUBLESHOOTING: (Refer to Fig. 34)

High speed rewinding mechanism isn't workable	Defect of the (11). Improper position of the (10). Trouble in circuit.	Fig. 35
Film counter malfunctions	Slip of the (7) or defect of the (7)(8)(9). Turning of the (7)(8)(9) is interrupted by wires.	

DISASSEMBLY:

1. Unscrew the (2)x2 and take off the (1).
2. Unscrew the (4) and take off the (5).
3. Unscrew the (6) and take off the (3).
4. For further disassembly, refer to Fig. 34.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. When disassembling the (1), reassemble it with backlash between (7) and (8).
3. Make sure that the (11) turns on exactly when the (5) is pulled for high speed rewinding.

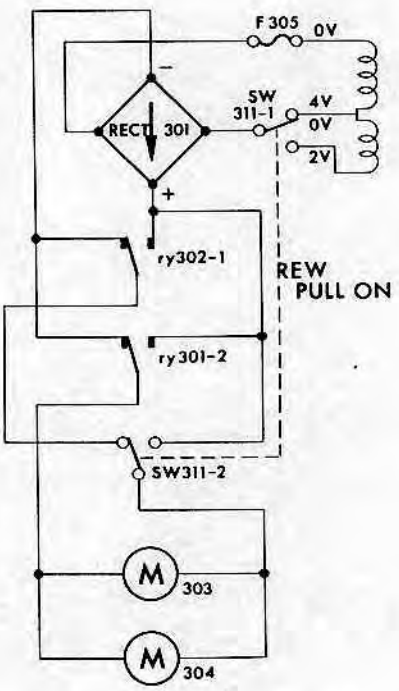


FIG. 35

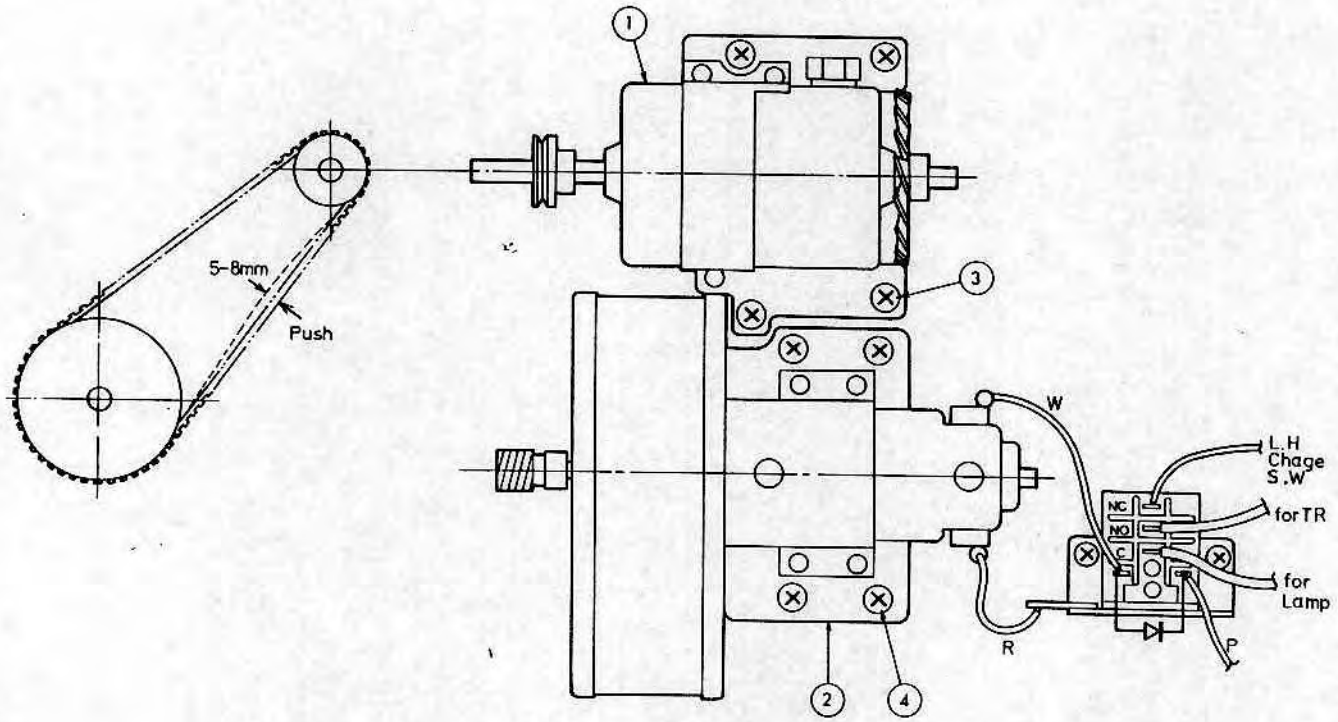


FIG. 36

B. Main Motor (1) and Fan Motor (2)

TROUBLESHOOTING: (Refer to Fig. 36)

No rotation of (1) and/or (2)	Defect of (1)(2). Circuit trouble.	
Noise from (1) and/or (2)	Lack of oil on their shafts. Wipe off oil on contact surface of carbon brushes or replace the (1)(2).	
Slow rotation of main motor	Excessive tension of V belt. Circuit trouble.	Fig. 36-A
Turning of fan motor isn't changeable though FWD button is depressed	Circuit trouble.	

DISASSEMBLY:

Refer to Fig. 36.

REASSEMBLY NOTES:

1. Attach the (1) in place where the tension of V belt becomes as shown in Fig. 36-A.
2. When attaching the (2), refer to the reassembly notes No. 2 on Page 16.

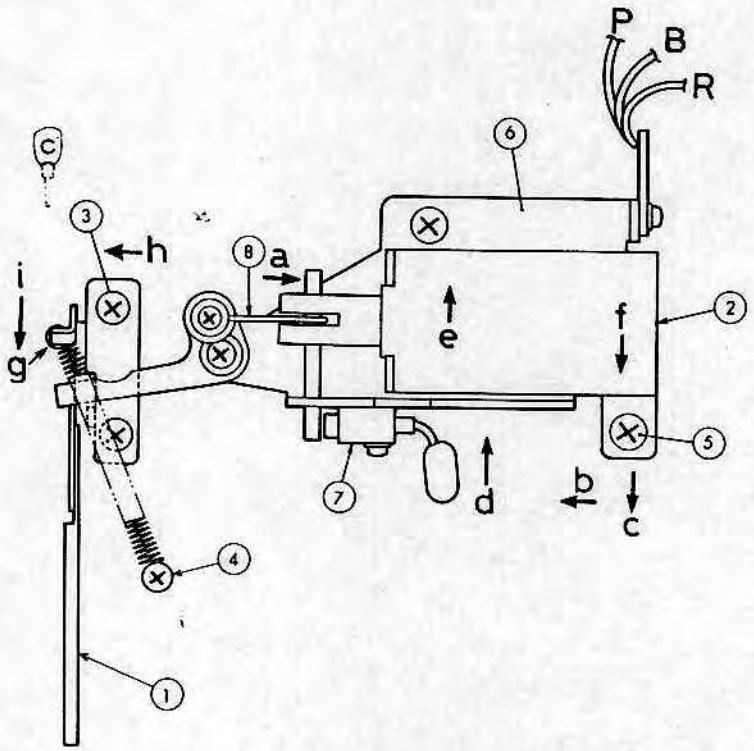


FIG. 37

C. Safety Shutter Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 37)

Uneven illumination by safety shutter Film is damaged by head in STILL projection	Safety shutter doesn't function normally. The (2) is defective or out of position.

DISASSEMBLY:

1. After removal of the main motor (Refer to Page 70) unscrew the (3)x2 and remove the (1).
   If necessity of removing the (4), take off the fan motor (Refer to Page 70) in advance.
2. Unscrew the (5)x2 and remove the (6) assembly. Unsolder the three wires on the (6).
3. For further disassembly, refer to Fig. 37.

REASSEMBLY NOTES:

1. The correlation position of the (2)(7) is where the (7) turns on when you push 'a' point of the (2) fully.
   If the (7) turns on quicker than normal timing, the (1) will stop on the way.
   If the (7) doesn't turn on at all, the (2) is burnt and becomes defective.
2. Bend the (8) if its movement isn't smooth in the (2)'s core slit owing to deflection of it.
3. When the movement distance of the (2)'s core, readjust the position of (2)(6)(1) as follows:

   Attach the (2), pushing it in the direction of 'e' and 'f'.
   Attach the (6), pushing it in the direction of 'b', 'c' and 'd'.
   Attach the (1), pushing it in the arrow direction.

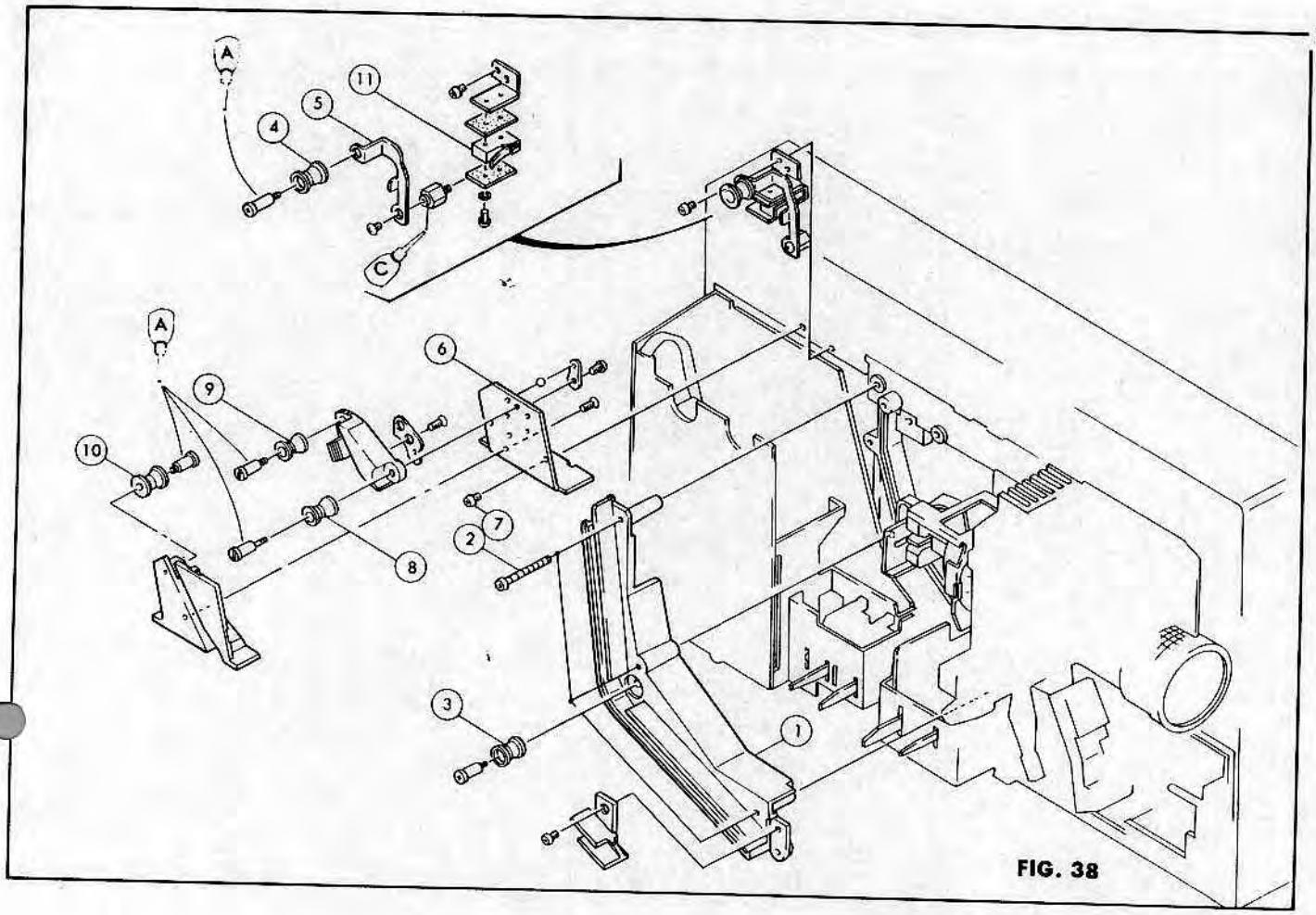


FIG. 38

D. Film Guide Assembly (1) and Take-up Guide Assembly (6)

TROUBLESHOOTING: (Refer to Fig. 38)

Unable to set back the auto-threading condition	The (11) is out of position or defective. The (5) malfunctions.
Film scratch	Flaws or poor turning of the (3)(4)(8)(9)(10).

DISASSEMBLY:

1. Unscrew the (2)x3 and remove the (1).
2. To remove the (6), take off the amplifier cover (Page 14) and unscrew the (7)x2.
3. For further disassembly, refer to Fig. 38.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each roller rotates smoothly.
3. Make sure that the (5) works perfectly after its reassembly.

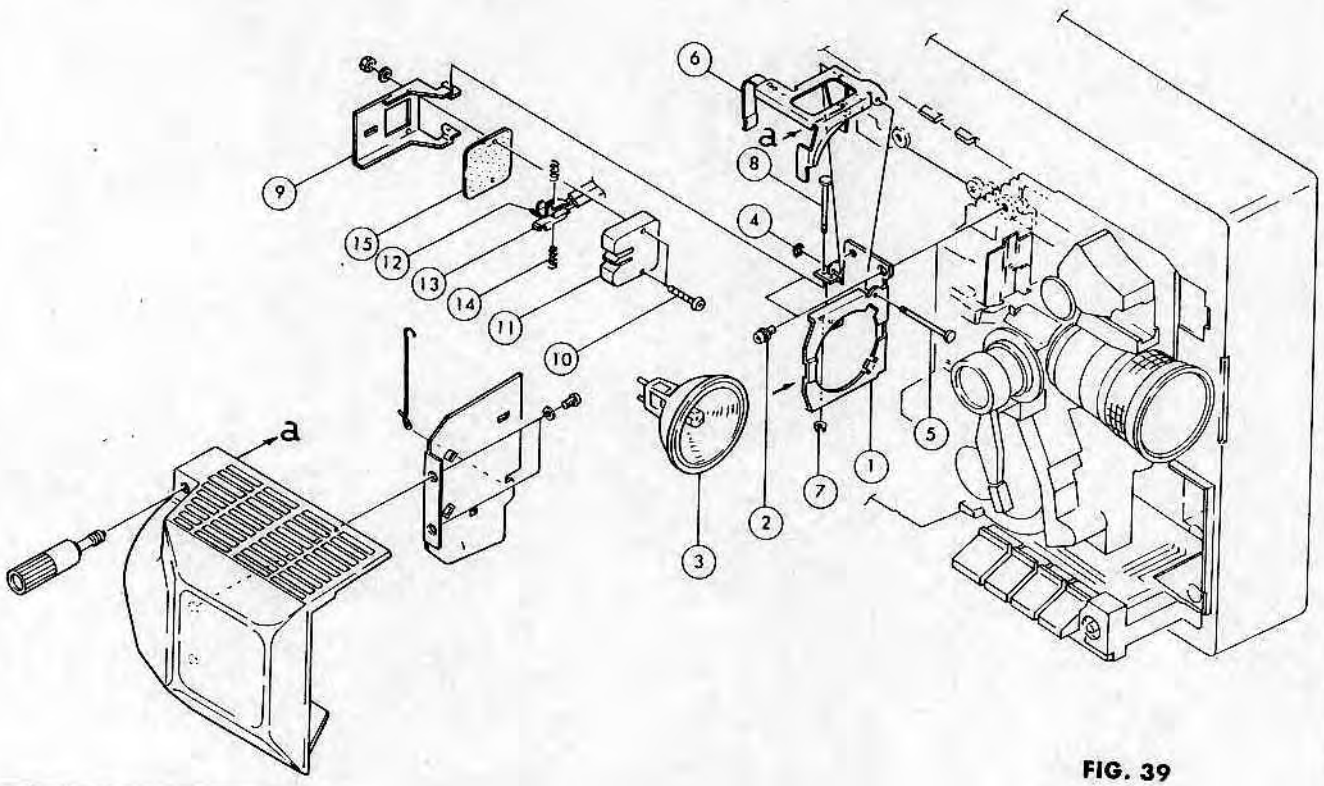


FIG. 39

E. Projection Lamp Socket Assembly

TROUBLESHOOTING: (Refer to Fig. 39)

Unstable lighting	Defect of the (12)(13)(14).
Difficult to replace the lamp	Defect of the (1)(6).
Uneven illumination	The (1) is out of position. The (3) deteriorates.

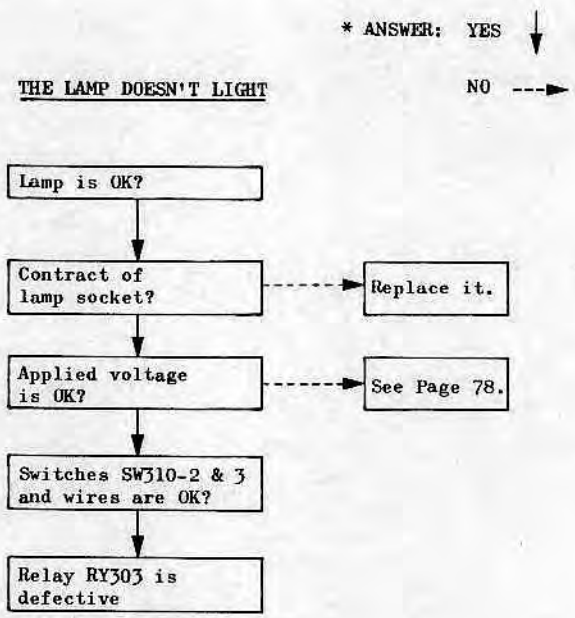
DISASSEMBLY:

Refer to Fig. 39.

REASSEMBLY NOTES:

Adjust and tighten the (1)'s position with (2)x2 in place where the maximum illumination appears without unevenness.

THE LAMP DOESN'T LIGHT



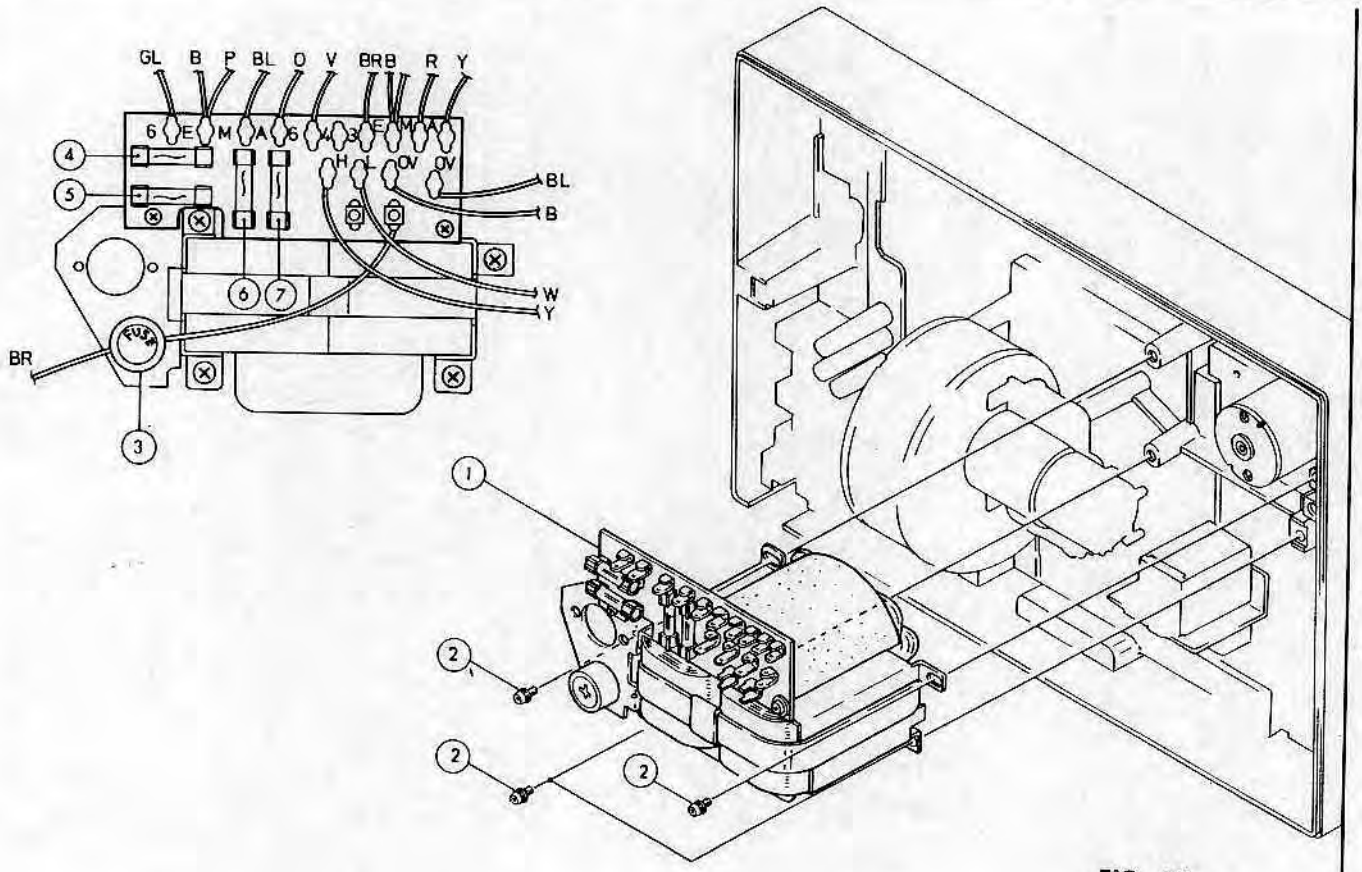


FIG. 40

F. Transformer

TROUBLESHOOTING: (Refer to Fig. 40)

Pilot lamp doesn't light	Defect of the (1) or breaking of the (3).
Main motor doesn't turn	Defect of the (1) or breaking of the (4).
Take-up motor doesn't turn	Defect of the (1) or breaking of the (5).
Fan motor doesn't turn	Defect of the (1) or breaking of the (6).
Main motor turns only slowly	Defect of the (1) or breaking of the (6).
Amplifier isn't workable (but exciter lamp lights)	Defect of the (1) or breaking of the (7).

DISASSEMBLY:

1. Unsolder the sixteen wires from the (1). Note that a brown wire is unsoldered from the (3).
2. Unscrew the (2)x4 and remove the (1).

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each wire is surely connected in place.
3. Refer to the under list when trouble happens in the take-up/rewind motors.
   The combination of the unloaded power-supply voltage for the motors have been changed at two times.

Voltage at 3V terminal	Voltage at 4V terminal	Applied GS-1200
about 3.8V	about 4.6V	initial production
3.4V	4.2V	
3.8V	4.2V	recent production

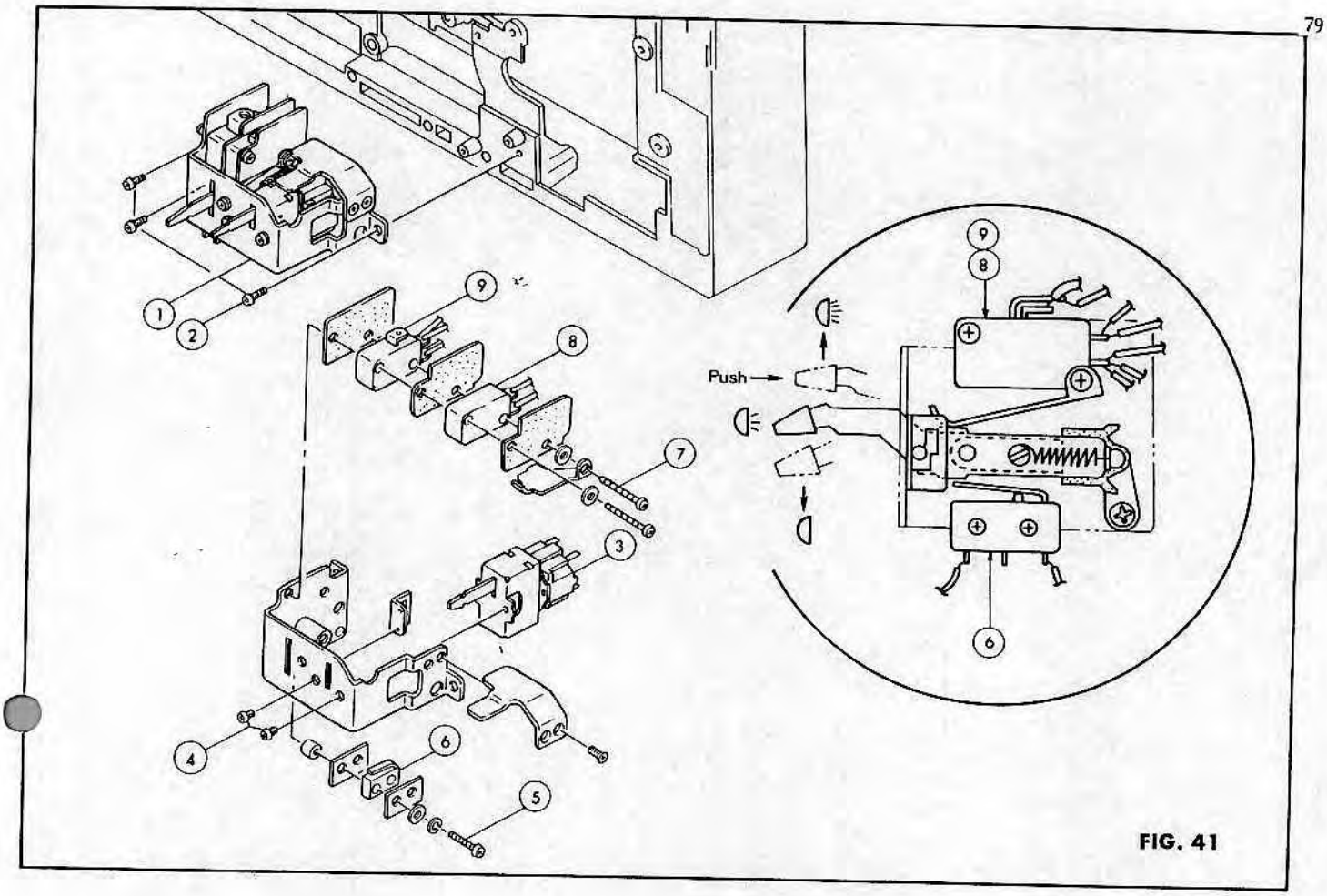


FIG. 41

G. Power and Lamp Switch Unit

TROUBLESHOOTING: (Refer to Fig. 41)

No power though the switch is ON	The (3) is defective.
Projection lamp doesn't light	The (6)(8)(9) are defective.
Relay doesn't work	The (6) is defective.
Unable to shift High-Low illuminance	The (8)(9) are defective.
Projection lamp isn't preheated	The (9) is defective.

DISASSEMBLY:

1. Unscrew the (2)x3 and remove the (1) with wires.
2. For further disassembly, refer to Fig. 41.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure each lever surely works.
3. Make sure each switch surely works.

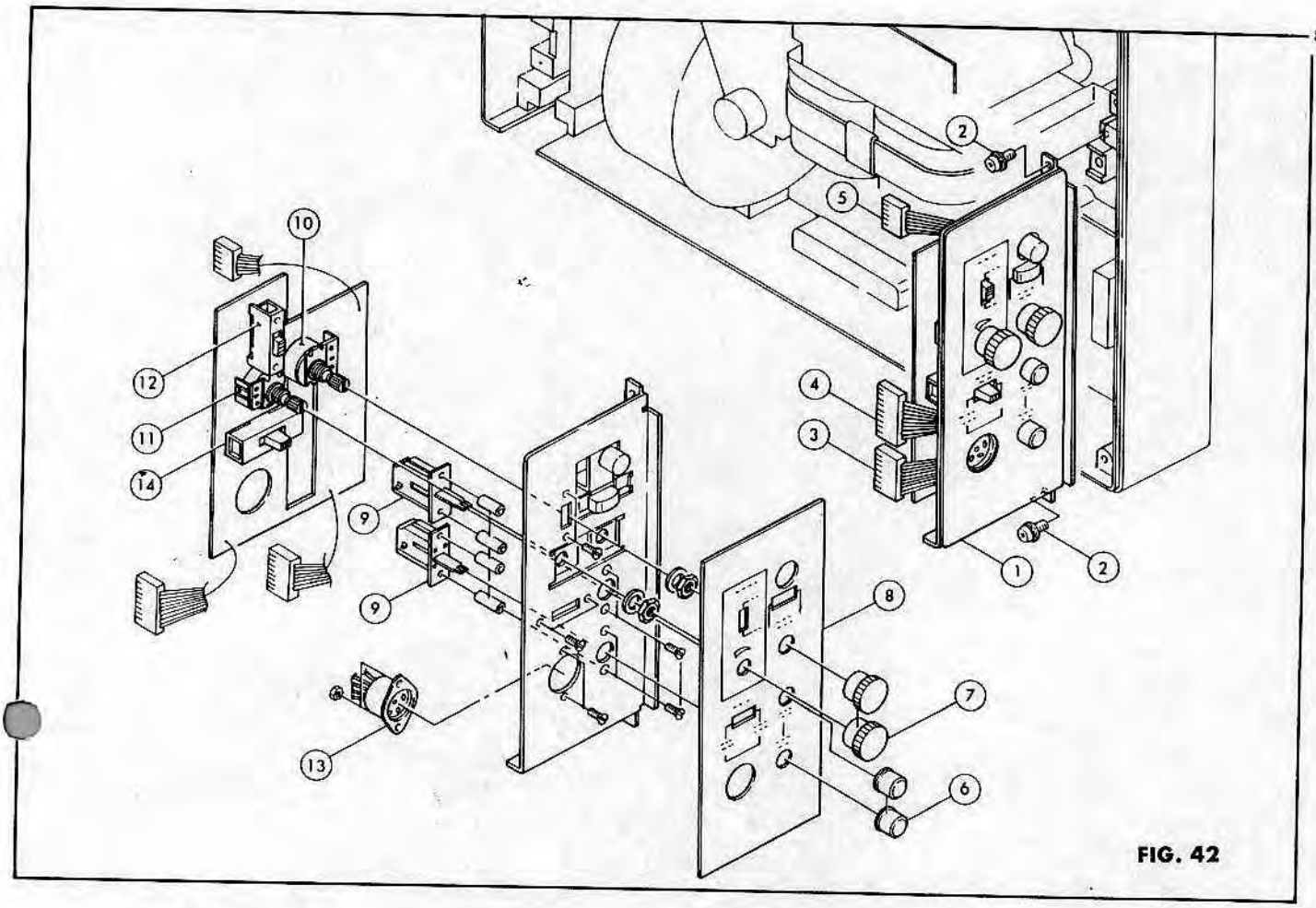


FIG. 42

6. ESS CIRCUIT SECTION

A. ESS Circuit Board Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 42)

Unable to shift speed of 18/24 fps	The (12) is soldered poorly or defective.
Unable to adjust speed of ± 1 fps	The (11) is soldered poorly or defective.
Unable to record/play back ESS pulse	Half-contact of the (13) or defect of the (14).
ESS mechanism doesn't work at all (Refer to Page 83)	The (10) is soldered poorly or defective. Defect of (14).
Unable to adjust speed of SLOW/FAST	The (9) is defective.
Not synchronize with tape recorder (Refer to Page 84)	Short of 2 or 3 pin of (3). The (3) is defective.

DISASSEMBLY:

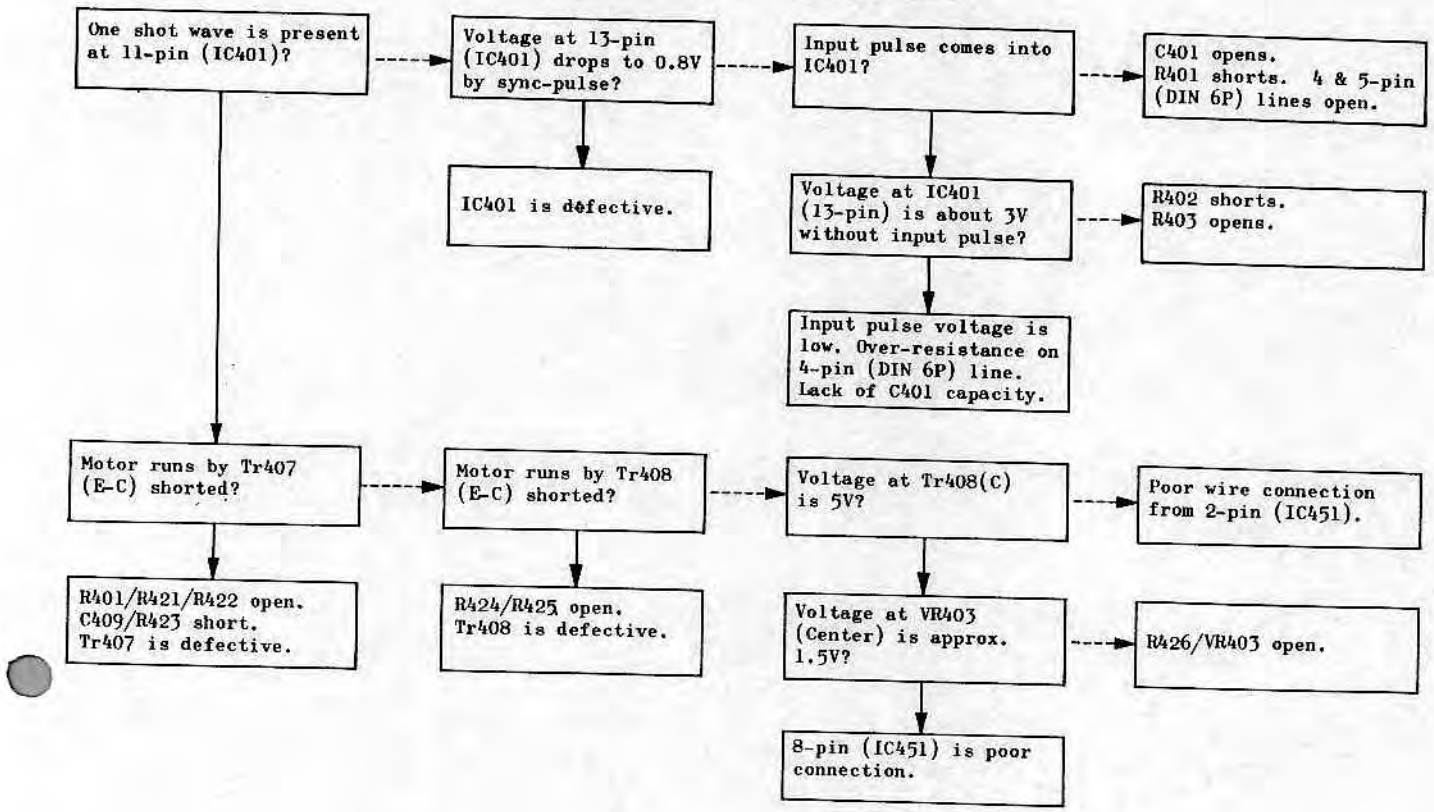
1. Unscrew the (2)x2 and disconnect the (3)(4)(5). Detach the (1) from the projector.
2. Pull out the (6)x2, (7)x2 and peel off the (8).
3. For further disassembly, refer to Fig. 42.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure the (9)(10)(11)(12)(14) are surely soldered on the board as they will take off easily.

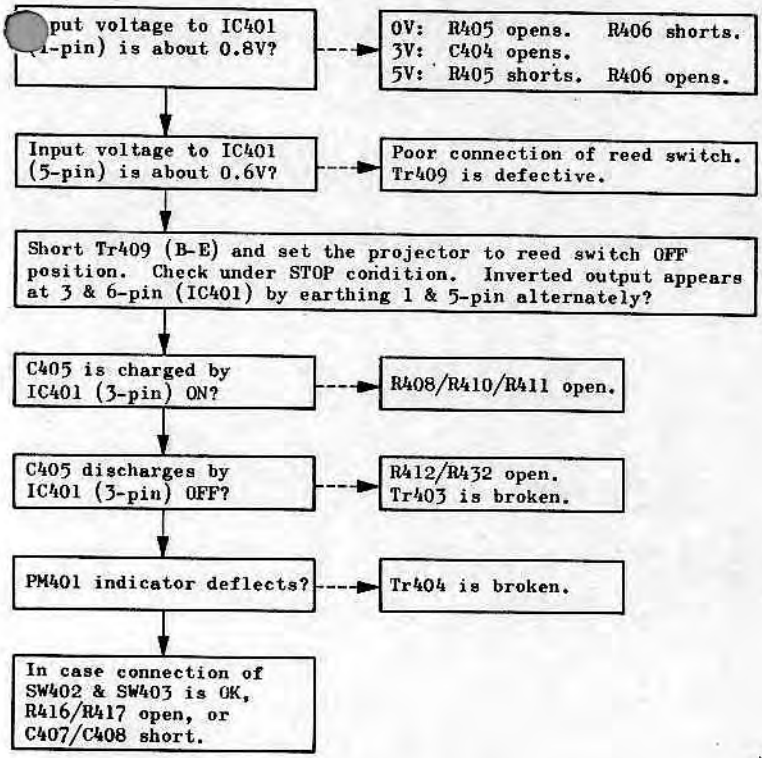
B. Troubleshooting

PROJECTOR DOESN'T START BY SYNC-PULSE

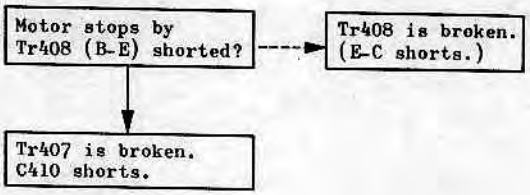

One shot wave is present at 11-pin (IC401)?
Voltage at 13-pin (IC401) drops to 0.8V by sync-pulse?
IC401 is defective.
Input pulse comes into IC401?
C401 opens. R401 shorts. 4 & 5-pin (DIN 6P) lines open.
Voltage at IC401 (13-pin) is about 3V without input pulse?
R402 shorts. R403 opens.
Input pulse voltage is low. Over-resistance on 4-pin (DIN 6P) line. Lack of C401 capacity.
Motor runs by Tr407 (E-C) shorted?
R401/R421/R422 open. C409/R423 short. Tr407 is defective.
Motor runs by Tr408 (E-C) shorted?
R424/R425 open. Tr408 is defective.
Voltage at Tr408(C) is 5V?
Poor wire connection from 2-pin (IC451).
Voltage at VR403 (Center) is approx. 1.5V?
R426/VR403 open.
8-pin (IC451) is poor connection.

B. Troubleshooting (Cont'd)

PROJECTOR DOESN'T SYNCHRONIZE WITH TAPE RECORDER


Input voltage to IC401 (1-pin) is about 0.8V?
0V: R405 opens. R406 shorts.
3V: C404 opens.
5V: R405 shorts. R406 opens.
Input voltage to IC401 (5-pin) is about 0.6V?
Poor connection of reed switch. Tr409 is defective.
Short Tr409 (B-E) and set the projector to reed switch OFF position. Check under STOP condition. Inverted output appears at 3 & 6-pin (IC401) by earthing 1 & 5-pin alternately?
C405 is charged by IC401 (3-pin) ON?
R408/R410/R411 open.
C405 discharges by IC401 (3-pin) OFF?
R412/R432 open. Tr403 is broken.
PM401 indicator deflects?
Tr404 is broken.
In case connection of SW402 & SW403 is OK, R416/R417 open, or C407/C408 short.

MOTOR RUNS SLOWLY WITHOUT INPUT PULSE



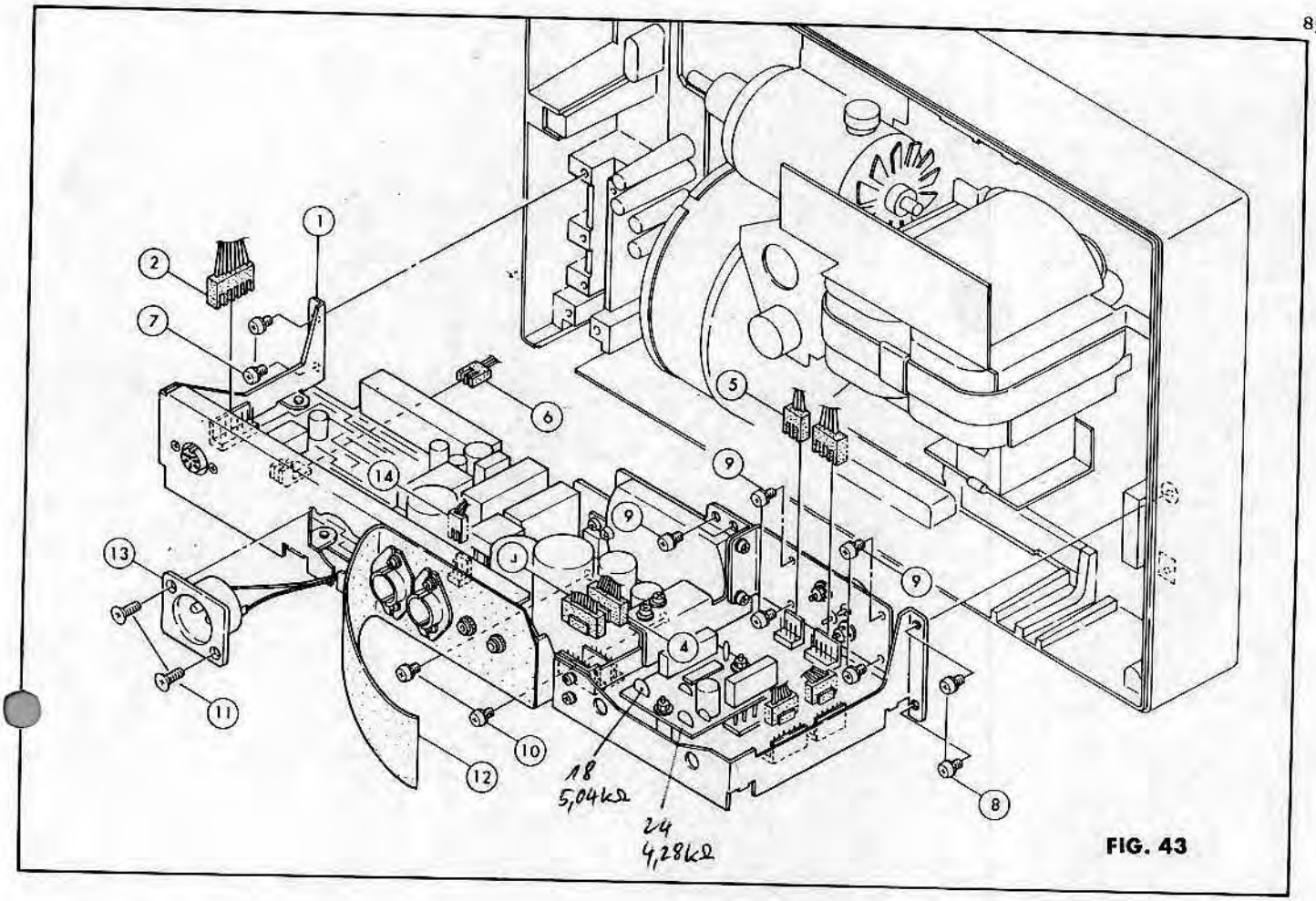


FIG. 43

7. CONTROL CIRCUIT SECTION

A. Control Circuit Board Assembly (1)

TROUBLESHOOTING: (Refer to Fig. 43)

Wow/Flutter	The wires being connected to connectors touch the rotation parts.
Control circuit board is broken	Poor connection of connectors. Circuit trouble (Pages 87-92).
Main motor doesn't run at 6 fps	Adjust it with semi-fixed resistor 'c', using a tool C005.
Main motor doesn't run at 18 fps	Adjust it with semi-fixed resistor 'a', using a tool C005.
Main motor doesn't run at 24 fps	Adjust it with semi-fixed resistor 'b', using a tool C005.
ESS sync-projection isn't well	Adjustable with semi-fixed resistor 'd'.

DISASSEMBLY:

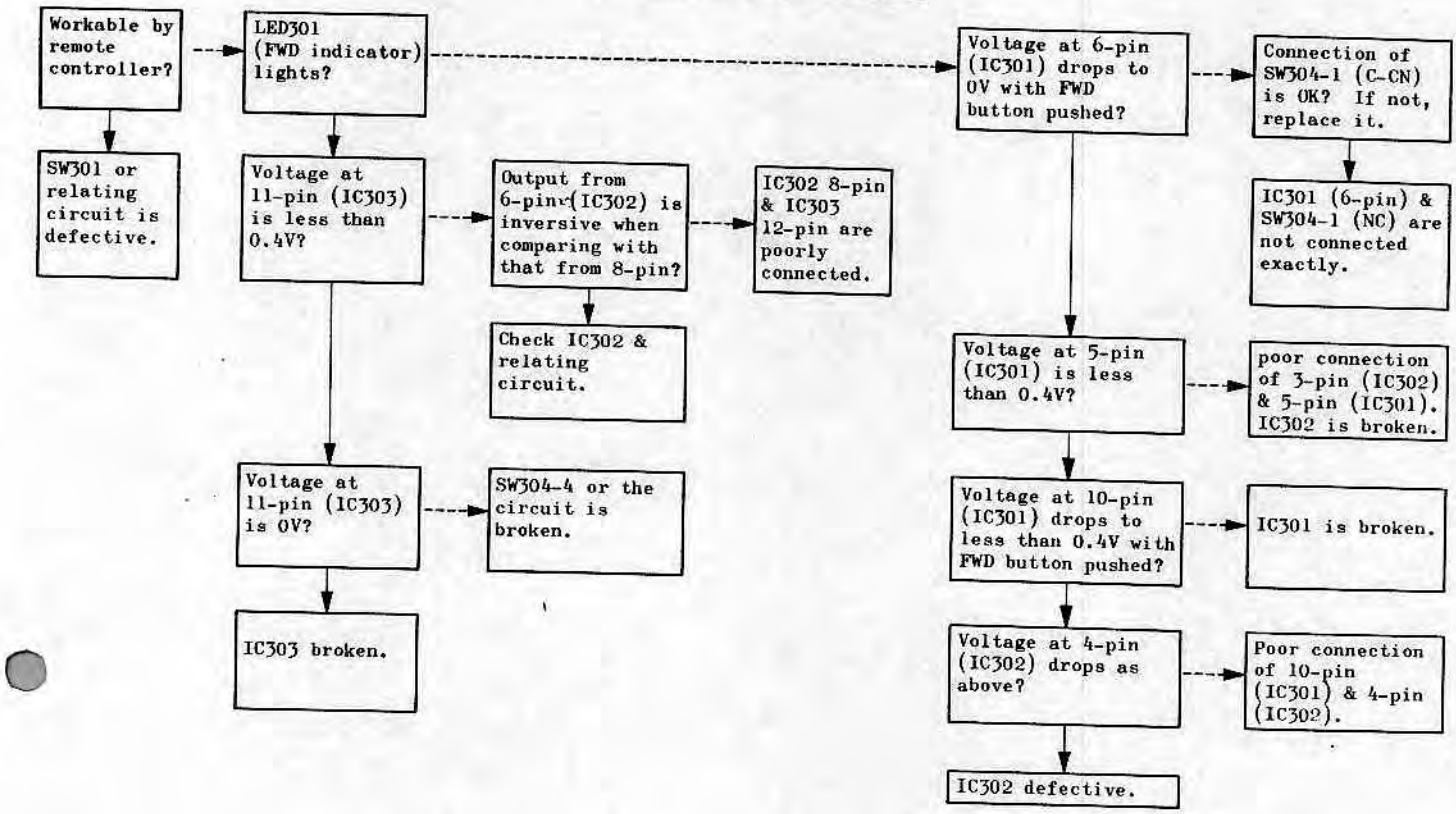
1. Disconnect the (2)(3)(4)(5)(6) with care not to break the wires.
   Disconnect the connectors indicated by dotted and virtual lines if not disconnected yet.
2. Unscrew the (7), (8)x2, (9)x6 and (10)x2. Unsolder the (13)'s wires along with (1)'s groove.
   Pull out the (1) toward you somewhat powerfully because it is connected by connector.

REASSEMBLY NOTES:

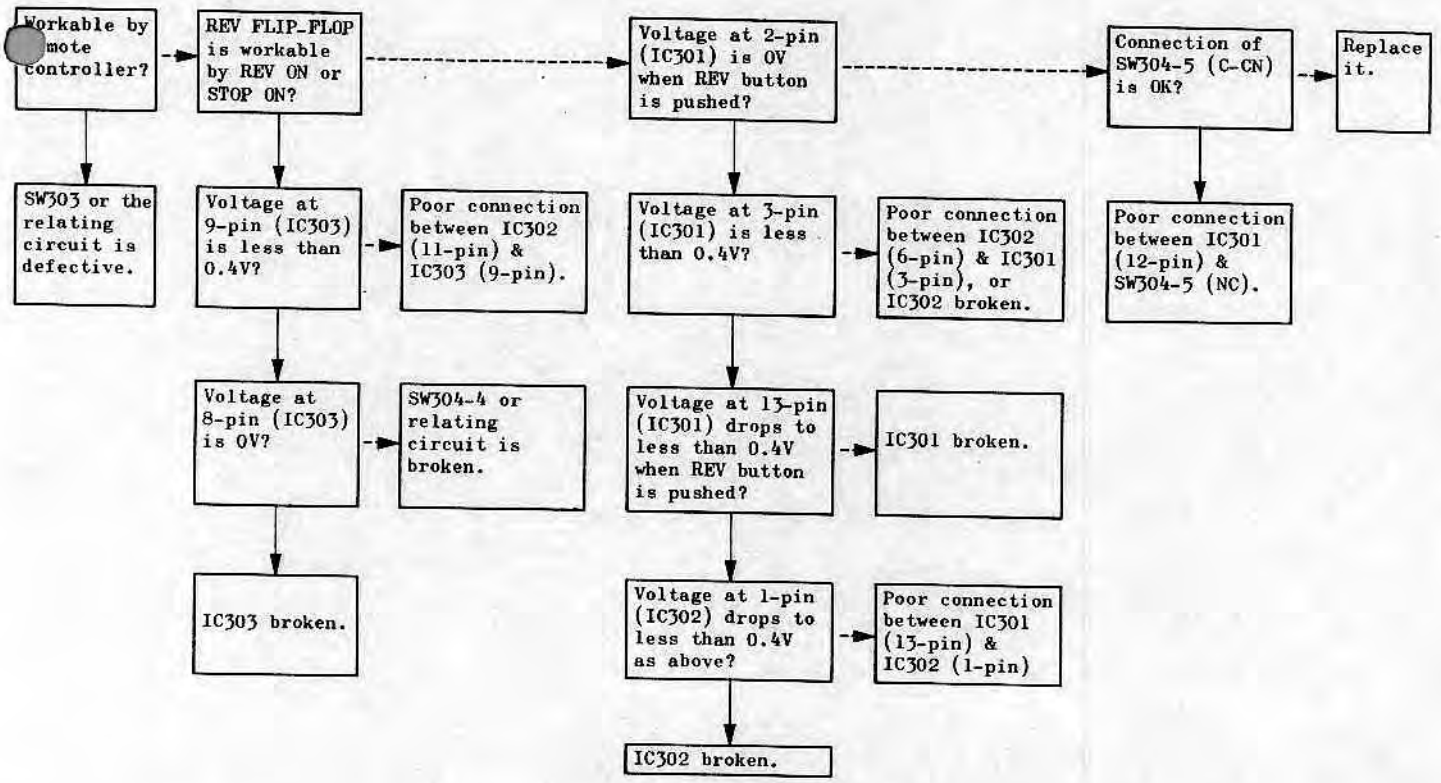
1. Follow the reverse way of the disassembly steps.
2. Connect the (5) after pulling out it from under a lot of wires bound.
3. Let the (14)'s wires come nears transformer and connect it.
4. Be careful not to cut or short-circuit thin wires.

B. Troubleshooting

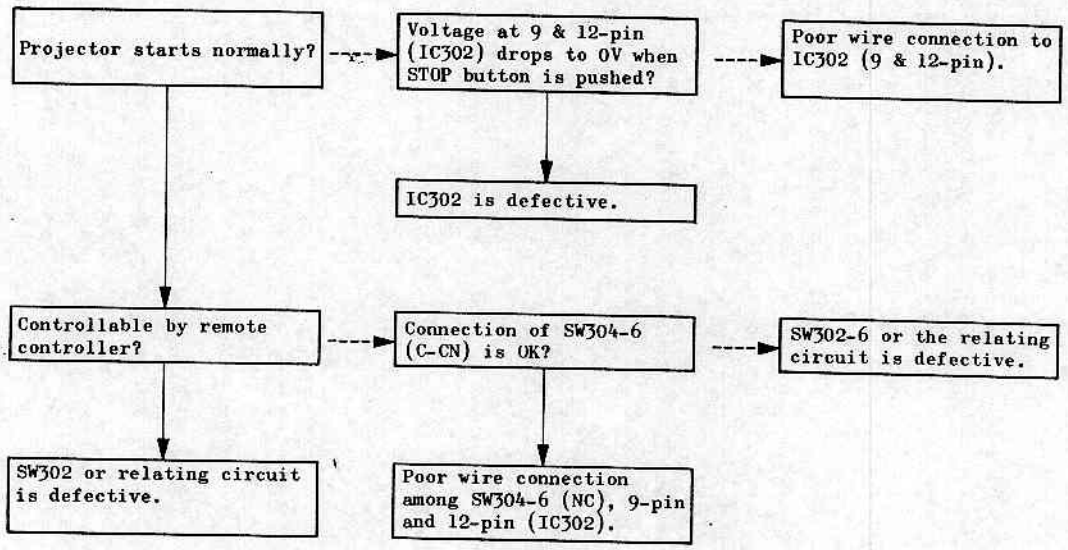
FWD PROJECTION ISN'T WORKABLE


Workable by remote controller?
LED301 (FWD indicator) lights?
Voltage at 6-pin (IC301) drops to 0V with FWD button pushed?
Connection of SW304-1 (C-CN) is OK? If not, replace it.
IC301 (6-pin) & SW304-1 (NC) are not connected exactly.
SW301 or relating circuit is defective.
Voltage at 11-pin (IC303) is less than 0.4V?
Output from 6-pin (IC302) is inversive when comparing with that from 8-pin?
IC302 8-pin & IC303 12-pin are poorly connected.
Check IC302 & relating circuit.
Voltage at 5-pin (IC301) is less than 0.4V?
poor connection of 3-pin (IC302) & 5-pin (IC301). IC302 is broken.
Voltage at 11-pin (IC303) is 0V?
SW304-4 or the circuit is broken.
Voltage at 10-pin (IC301) drops to less than 0.4V with FWD button pushed?
IC301 is broken.
IC303 broken.
Voltage at 4-pin (IC302) drops as above?
Poor connection of 10-pin (IC301) & 4-pin (IC302).
IC302 defective.

REV PROJECTION ISN'T WORKABLE

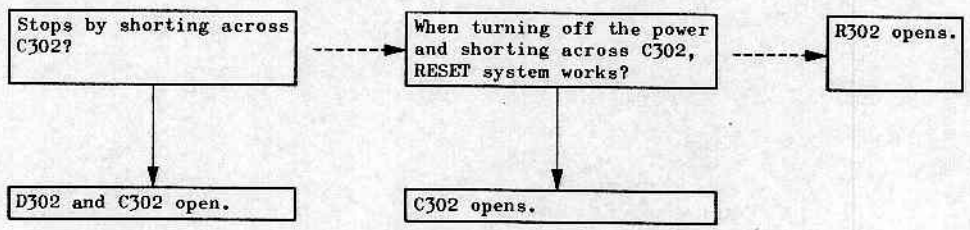

Workable by remote controller?
REV FLIP-FLOP is workable by REV ON or STOP ON?
Voltage at 2-pin (IC301) is 0V when REV button is pushed?
Connection of SW304-5 (C-CN) is OK?
Replace it.
SW303 or the relating circuit is defective.
Voltage at 9-pin (IC303) is less than 0.4V?
Poor connection between IC302 (11-pin) & IC303 (9-pin).
Voltage at 3-pin (IC301) is less than 0.4V?
Poor connection between IC302 (6-pin) & IC301 (3-pin), or IC302 broken.
Poor connection between IC301 (12-pin) & SW304-5 (NC).
Voltage at 8-pin (IC303) is 0V?
SW304-4 or relating circuit is broken.
Voltage at 13-pin (IC301) drops to less than 0.4V when REV button is pushed?
IC301 broken.
IC303 broken.
Voltage at 1-pin (IC302) drops to less than 0.4V as above?
Poor connection between IC301 (13-pin) & IC302 (1-pin)
IC302 broken.

PROJECTOR DOESN'T STOP

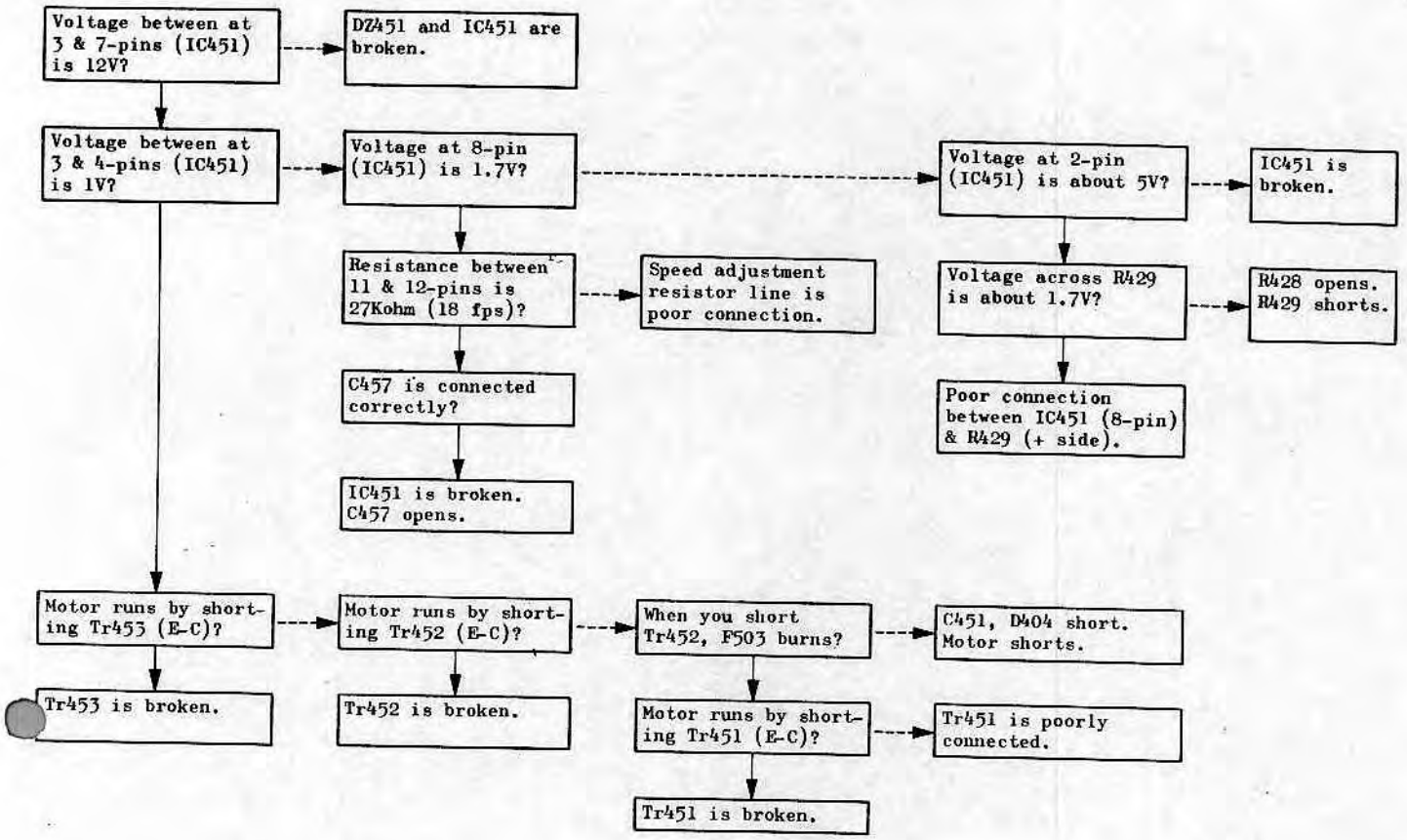

Projector starts normally?
Voltage at 9 & 12-pin (IC302) drops to 0V when STOP button is pushed?
Poor wire connection to IC302 (9 & 12-pin).
IC302 is defective.
Controllable by remote controller?
Connection of SW304-6 (C-CN) is OK?
SW302-6 or the relating circuit is defective.
SW302 or relating circuit is defective.
Poor wire connection among SW304-6 (NC), 9-pin and 12-pin (IC302).

PROJECTOR STARTS AS SOON AS POWER SWITCH IS ON

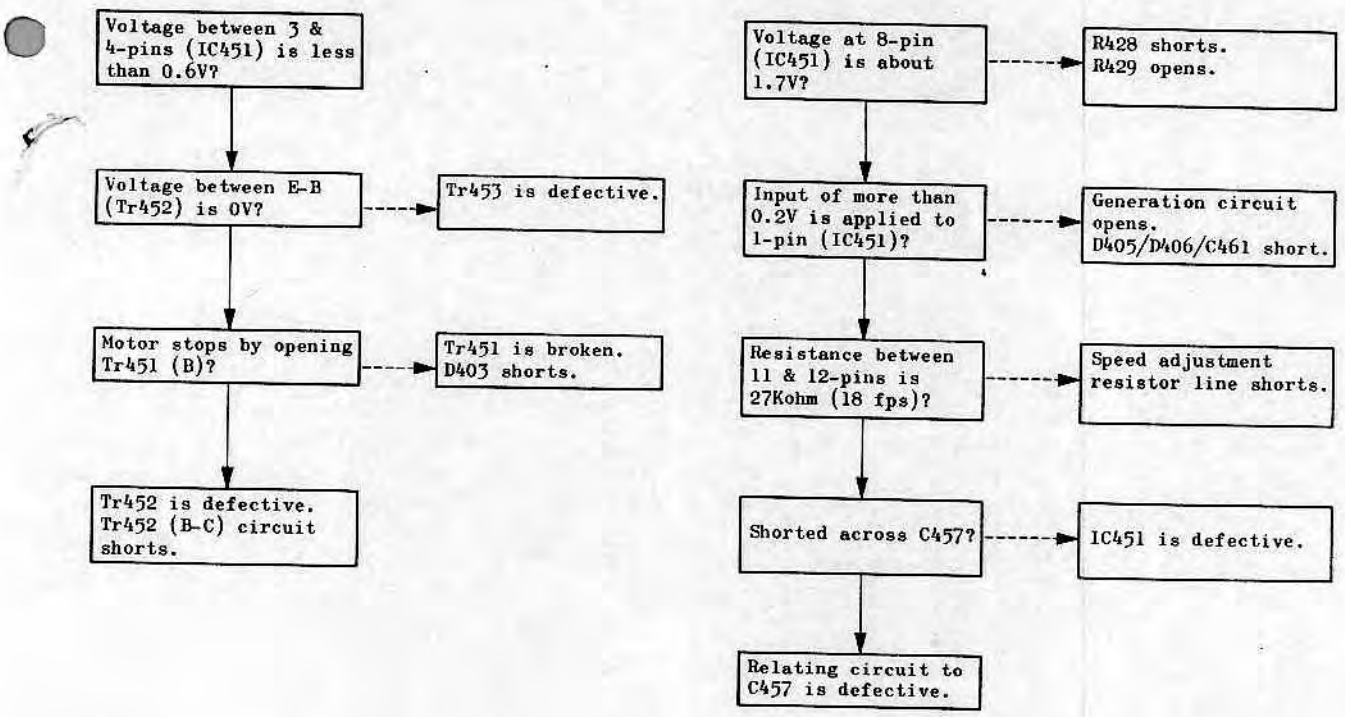
(Reset system isn't workable)


Stops by shorting across C302?
When turning off the power and shorting across C302, RESET system works?
R302 opens.
D302 and C302 open.
C302 opens.

MAIN MOTOR DOESN'T RUN


Voltage between at 3 & 7-pins (IC451) is 12V?
DZ451 and IC451 are broken.
Voltage between at 3 & 4-pins (IC451) is 1V?
Voltage at 8-pin (IC451) is 1.7V?
Voltage at 2-pin (IC451) is about 5V?
IC451 is broken.
Resistance between 11 & 12-pins is 27Kohm (18 fps)?
Speed adjustment resistor line is poor connection.
Voltage across R429 is about 1.7V?
R428 opens. R429 shorts.
C457 is connected correctly?
Poor connection between IC451 (8-pin) & R429 (+ side).
IC451 is broken. C457 opens.
Motor runs by shorting Tr453 (E-C)?
Motor runs by shorting Tr452 (E-C)?
When you short Tr452, F503 burns?
C451, D404 short. Motor shorts.
Tr453 is broken.
Tr452 is broken.
Motor runs by shorting Tr451 (E-C)?
Tr451 is poorly connected.
Tr451 is broken.

MOTOR ROTATION IS OUT OF CONTROL

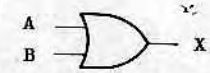
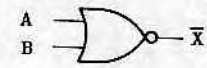
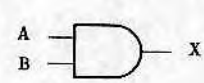
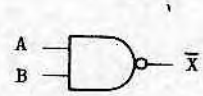
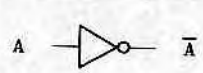

Voltage between 3 & 4-pins (IC451) is less than 0.6V?
Voltage at 8-pin (IC451) is about 1.7V?
R428 shorts. R429 opens.
Voltage between E-B (Tr452) is 0V?
Tr453 is defective.
Input of more than 0.2V is applied to 1-pin (IC451)?
Generation circuit opens. D405/D406/C461 short.
Motor stops by opening Tr451 (B)?
Tr451 is broken. D403 shorts.
Resistance between 11 & 12-pins is 27Kohm (18 fps)?
Speed adjustment resistor line shorts.
Tr452 is defective. Tr452 (B-C) circuit shorts.
Shorted across C457?
IC451 is defective.
Relating circuit to C457 is defective.

C. Circuit Analysis

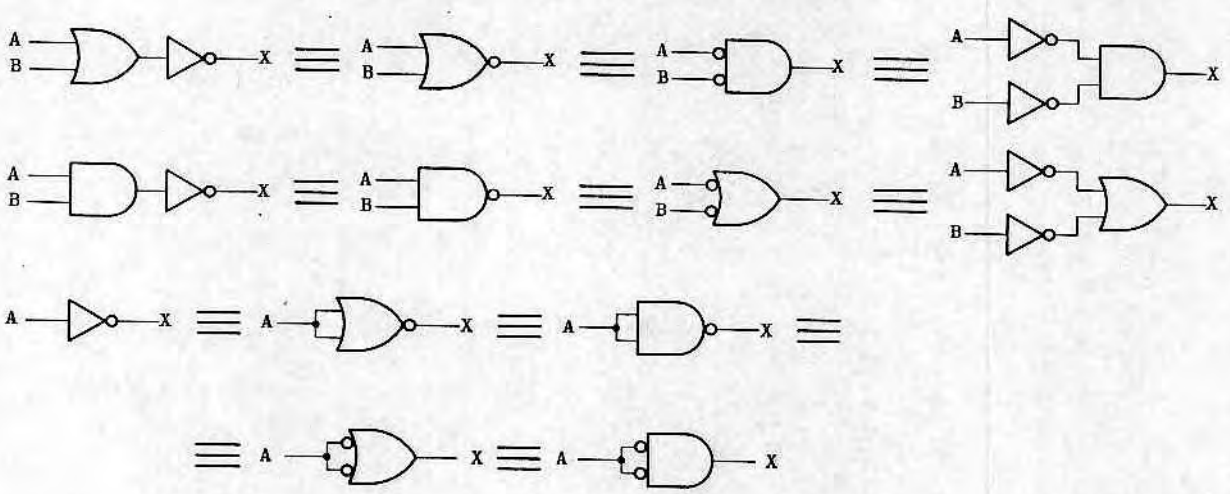
a. Logical Circuit

When a voltage at input/output of the logical circuit gate is high -- Vcc (Supplied voltage), it is called '1' or 'High' and when low (0V), it is called '0' or 'Low'. The symbol 'o' of the gate means the inversion of the signal (Inverter). Inverter means that the inversion of '0' is '1' and vice versa.

GATE:

OR gate		A B X 0 0 0 0 1 1 1 0 1 1 1 1	A + B = X (1 + 1 = 1)	Only in the case both A and B are 0, X=0. When A is 1, X+0 regardless of B.
NOR gate		A B $\overline{X}$ 0 0 1 0 1 0 1 0 0 1 1 0	A + B = $\overline{X}$	$\overline{X}$ is inversion of X of OR gate. When X is 1 at OR gate, $\overline{X}$ is 0 at this NOR gate and vice versa. When X is 0 at OR gate, $\overline{X}$ is 1 at this NOR gate.
AND gate		A B X 0 0 0 0 1 0 1 0 0 1 1 1	A x B = X	Only in the case A and B are 1, X=1. When A is 0, X=0 regardless of B.
NAND gate		A B $\overline{X}$ 0 0 1 0 1 1 1 0 1 1 1 0	A x B = $\overline{X}$	$\overline{X}$ is inversion of X of AND gate.
INVERTER		A $\overline{A}$ 0 1 1 0		$\overline{A}$ is inversion of A.

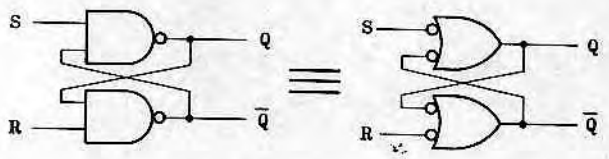
EQUIVALENT GATE:



a. Logical Circuit (Cont'd)

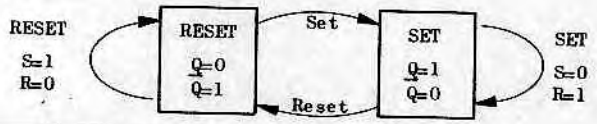
GATE COMBINATION:

RS Flip-Flop (RS F.F.)

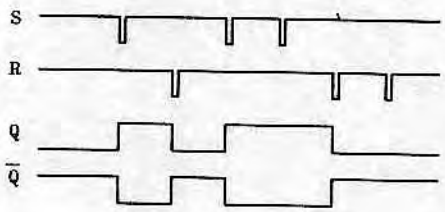


This circuit is workable by the input of only 0 pulse.
When S is 0, Q will be 1.
When R is 0, Q will be 0. ($\overline{Q}$ is the inversion of Q.)
Don't apply input of 0 to both S and R. (Inhibited input)

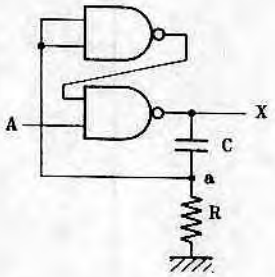
Transition Chart



Timing Chart

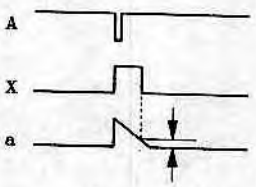


One Shot



When 0 pulse is given to A, the plus wave continues to come from X for the period of time pre-controlled by C.R.

Timing Chart



L level of input at NAND gate

a. Logical Circuit (Cont'd)

STATE OF THE PROJECTOR:

Correlation between operation and signal at each point of ICs

Operation Key / Signal Name in Circuit Diagram / State	FWD	FWD→STILL	FWD/REV→OFF	FWD/REV→STILL→OFF	REV	REV→STILL
	Forwarding	Still in forwarding	Stop	Stop after STILL	Reversing	Still in reversing
FWD	O	O				
$\overline{\text{FWD}}$			O	O	O	O
REV					O	O
$\overline{\text{REV}}$	O	O	O	O		
FWD $\overline{\text{STILL}}$	O					
$\overline{\text{FWD}}$ $\overline{\text{STILL}}$		O	O	O	O	O
REV $\overline{\text{STILL}}$						O

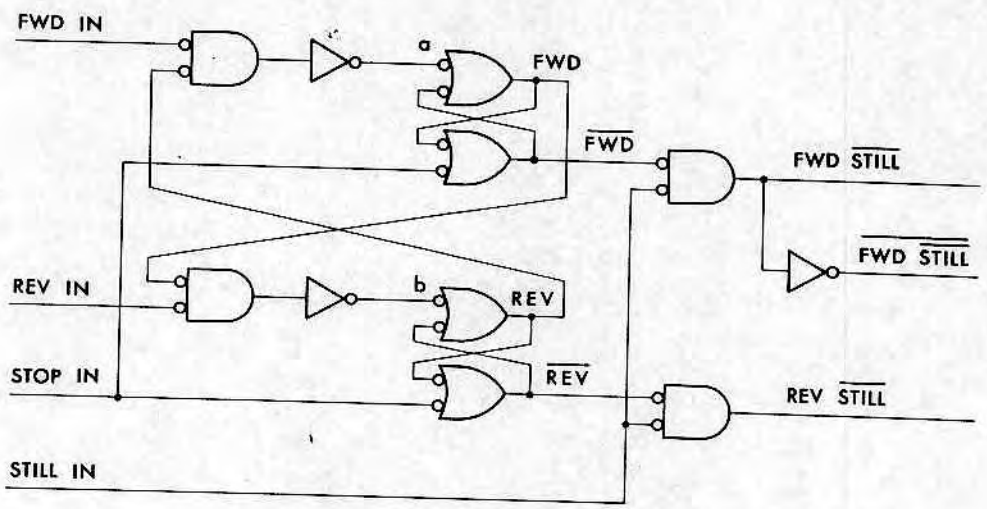
Remark: Should be read the FWD and $\overline{\text{FWD}}$ signal as FWD $\overline{\text{STILL}}$ and $\overline{\text{FWD}}$ $\overline{\text{STILL}}$ respectively, in the control circuit diagram (-- going to Amplifier).

These FWD and $\overline{\text{FWD}}$ are muting power on recording.

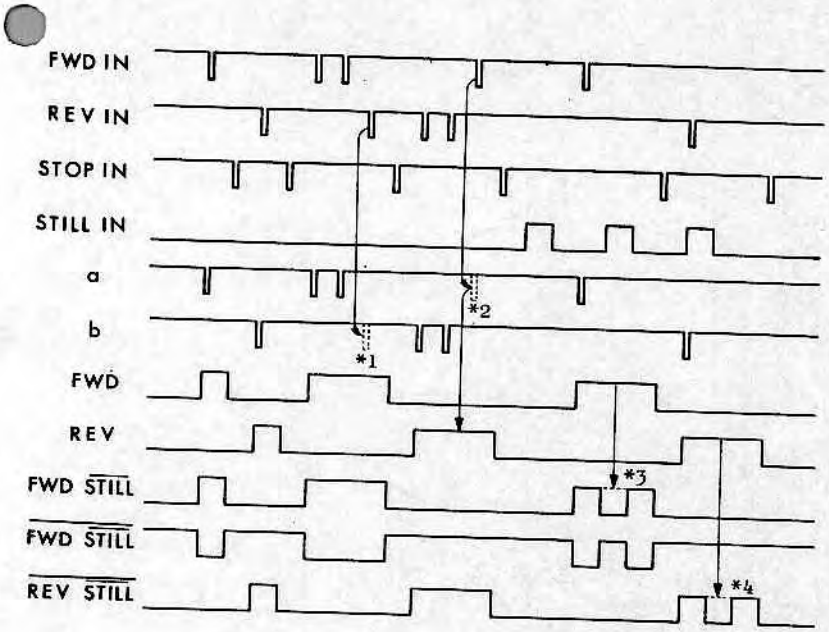
a. Logical Circuit (Cont'd)

GATE CIRCUIT USED IN THE GS-1200:

Control Circuit for FWD and REV



Timing Chart



*1: REV input is not effective even if REV button is pushed during FWD projection.

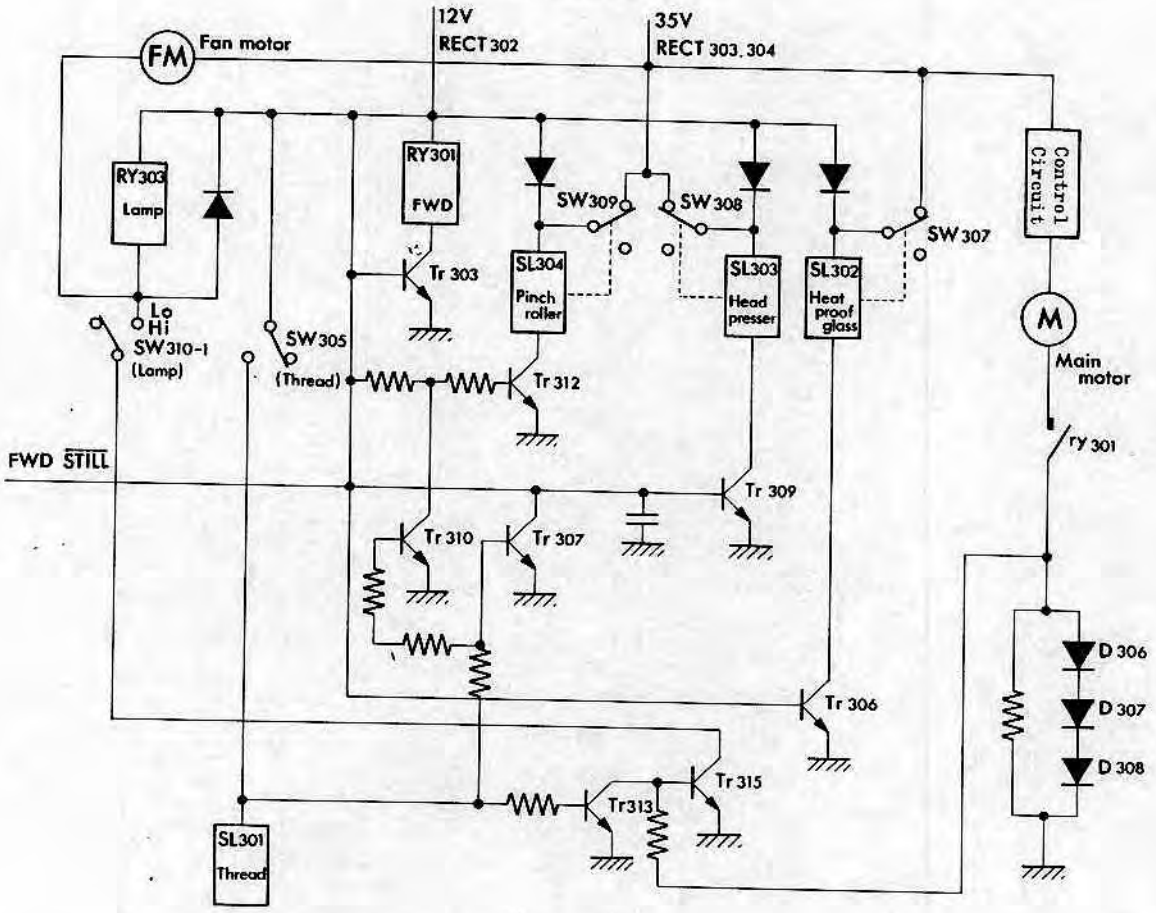
*2: FWD input is not effective even if FWD button is pushed during REV projection.

*3: The state of FWD F.F. (Flip-Flop) doesn't change even if STILL button is pushed while the FWD F.F. is set, but final output (FWD $\overline{STILL}$) is stopped until STILL button is pushed again.

*4: REV F.F. is the similar function to FWD F.F.

NOTE:
All inputs (FWD, STOP, REV) are raised to High when STILL button is once pushed.

FWD Circuit



b. FWD Circuit (Refer to Page 99)

FWD PROJECTION:

1. When you turn FWD switch on, the output FWD STILL will be changed to High by operation of FWD starting circuit.
2. Current flows in RY301 and the main motor starts running. SL302 for heat-proof glass works.
3. A bit late, SL304 for pinch roller and SL303 for head presser work.
4. Since Tr307 is ON during optical projection (OPT), the SL303 does not work.

DURING AUTO-THREADING:

1. Since Tr313 is ON, Tr315 does not work and projection lamp does not light. FM (Fan Motor) does not run at high speed.
2. Since Tr310 is ON, neither Tr312 nor SL304 works.
3. Since Tr307 is ON, neither Tr309 nor SL303 works.

FAN MOTOR:

The motor turns slowly by the potential difference between 35V and 12V while the projection lamp is being preheated.

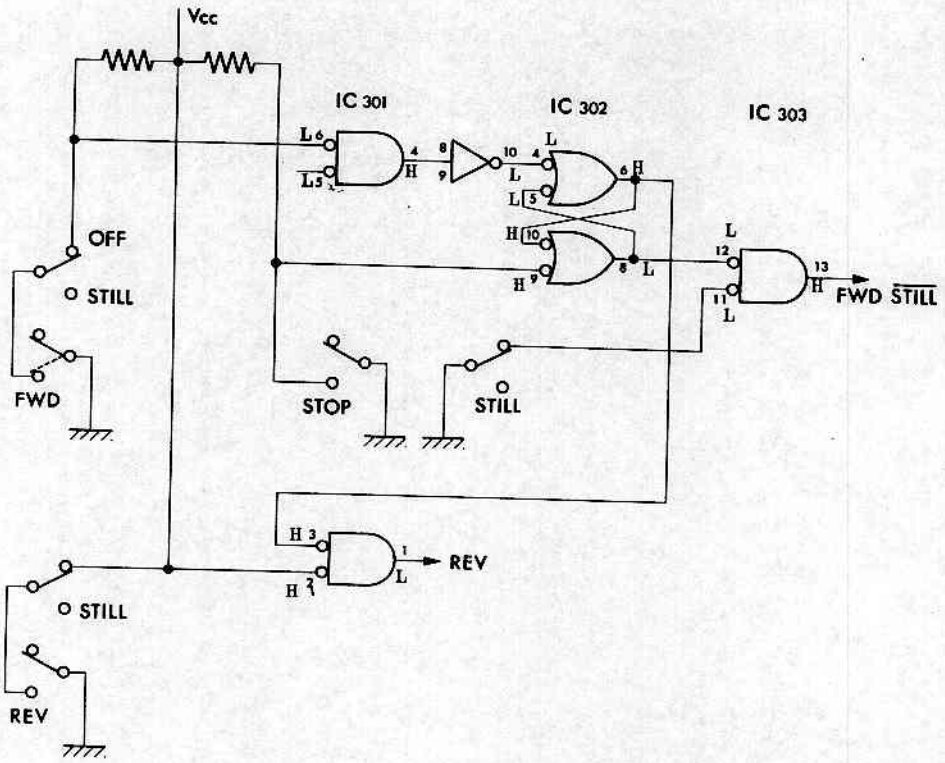
LAMP CIRCUIT:

While the main motor is running, the positive potential is generated by D306, D307 and D308.
It turns Tr315 on and RY303 works.

SL CIRCUIT:

For actuating the SL's, current flows from RECT303/304 (35V)/SW307/SW308/SW309 into SL's because their attraction power is insufficient. Once SL's work, they continue working with current supplied from RECT302 (12V).
Decreasing the current prevents SL from overheating.

FWD Starting Circuit



b. FWD Circuit (Cont'd)

FWD STARTING CIRCUIT: (Refer to Page 101)

1. By pushing the FWD button, voltage at each pin changes as shown in the circuit diagram on Page 101 and FWD projection starts.

2. Even when FWD button is released (voltage at 4-pin of IC302 returns to High), FWD projection goes on because voltage at 5-pin (IC302) is Low and that at 6-pin (IC302) keeps High.

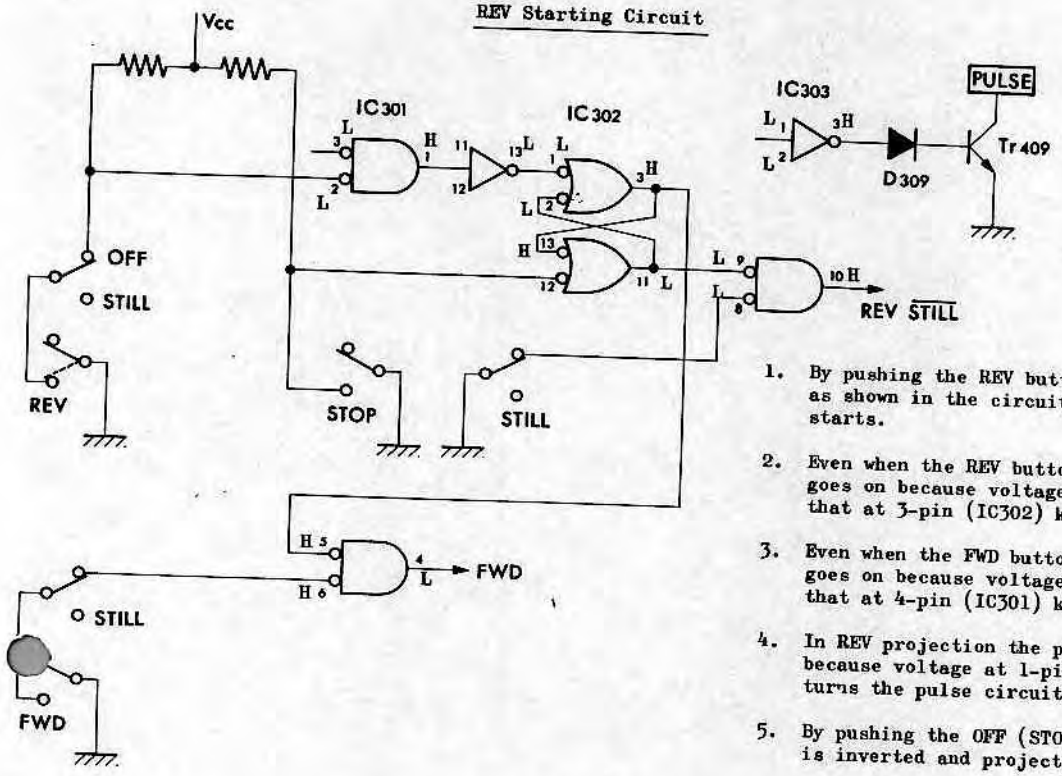
3. Even when REV button is pushed (voltage at 2-pin of IC301 changes to Low), FWD projection goes on because voltage at 3-pin (IC301) is High and that at 1-pin (IC301) keeps Low.

4. By pushing the OFF (STOP) button, voltage at each pin is inverted and FWD projection stops accordingly.

c. REV Starting Circuit

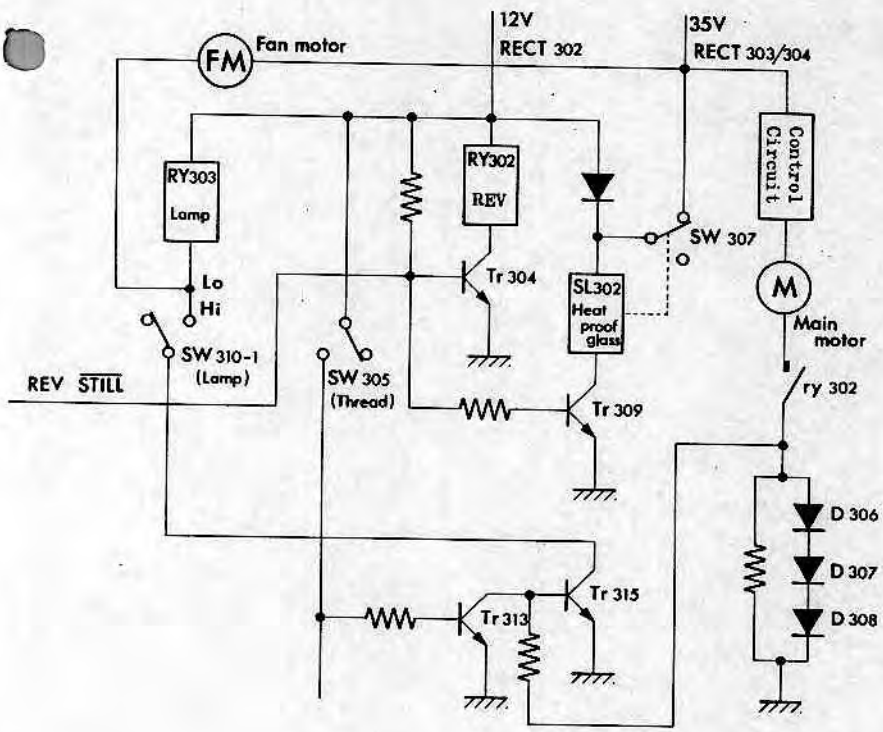
REV Starting Circuit

(H: High
L: Low)



1. By pushing the REV button, voltage at each pin changes as shown in the circuit diagram and REV projection starts.
2. Even when the REV button is released, REV projection goes on because voltage at 2-pin (IC302) is Low and that at 3-pin (IC302) keeps High.
3. Even when the FWD button is pushed, REV projection goes on because voltage at 5-pin (IC301) is High and that at 4-pin (IC301) keeps Low.
4. In REV projection the pulse circuit does not work because voltage at 1-pin (IC303) is High and Tr409 turns the pulse circuit off.
5. By pushing the OFF (STOP) button, voltage at each pin is inverted and projector stops.

REV Circuit



LAMP CIRCUIT:

While main motor is running, positive potential is generated by D306, D307 and D308.

Then Tr315 turns on and RY303 works.

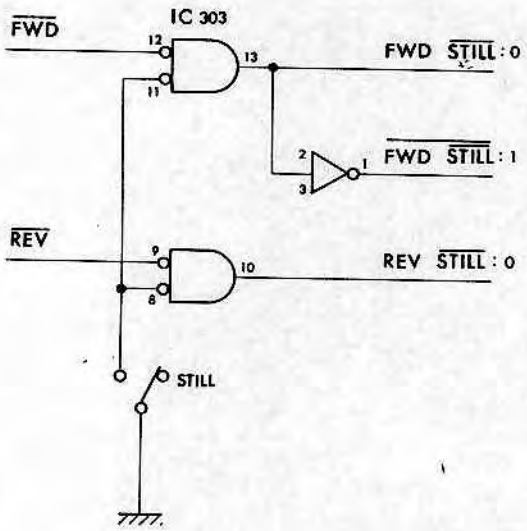
SL CIRCUIT:

Since the output (REV $\overline{\text{STILL}}$) is High, Tr304 turns on and RY302 works.

Tr306 turns on. SL302 turns the SW307 off and continues to work by the current supplied from RECT302.

d. STILL Function Circuit

STILL Function Circiut

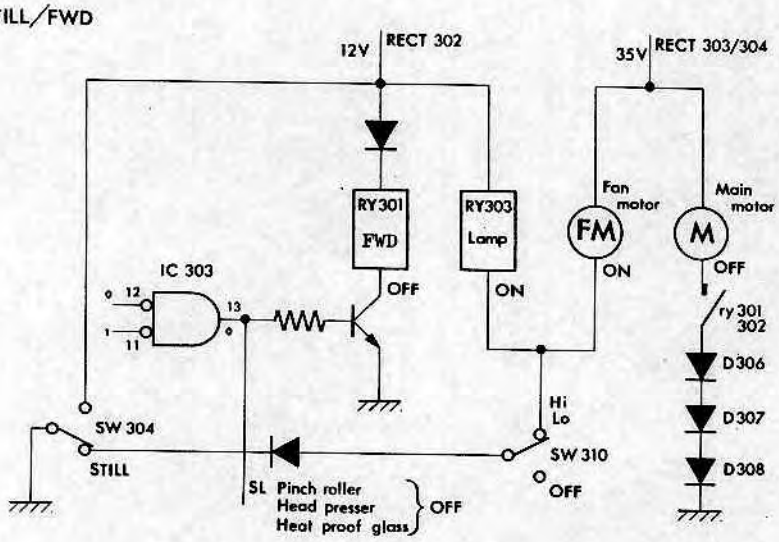


When you push the STILL button, each input of FWD, OFF and REV is cut regardless of their position.

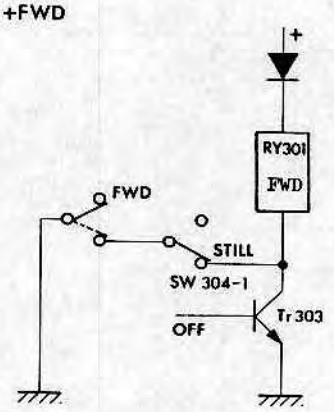
As soon as you push the STILL button, each input and output at pins of IC303 changes as follows.

Pin No.		Voltage	
8-pin		High	
11-pin		High	
13-pin	(FWD STILL)	Low	(regardless of 12-pin voltage)
10-pin	(REV STILL)	Low	(regardless of 9-pin voltage)
1-pin	(FWD STILL)	High	(STILL projection starts)

STILL/FWD

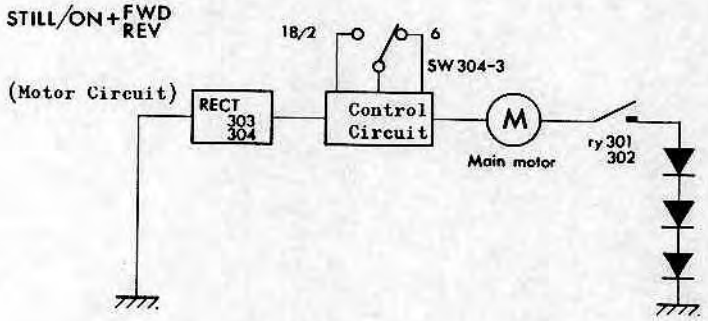


STILL/ON+FWD

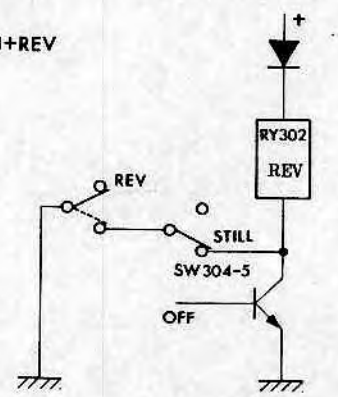


Only while pushing FWD/REV button, slow motion is possible.

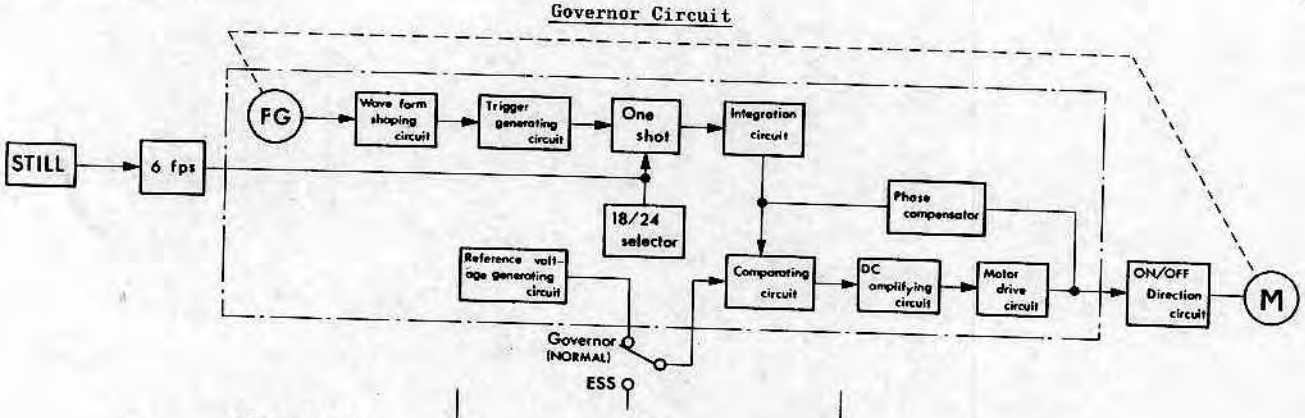
STILL/ON+FWD REV

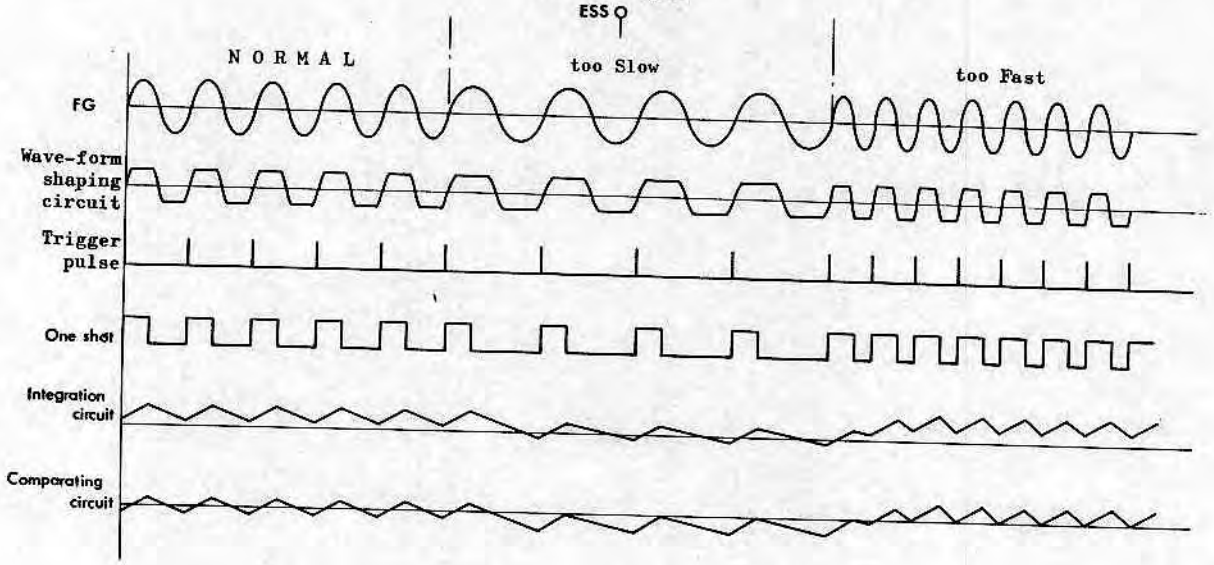


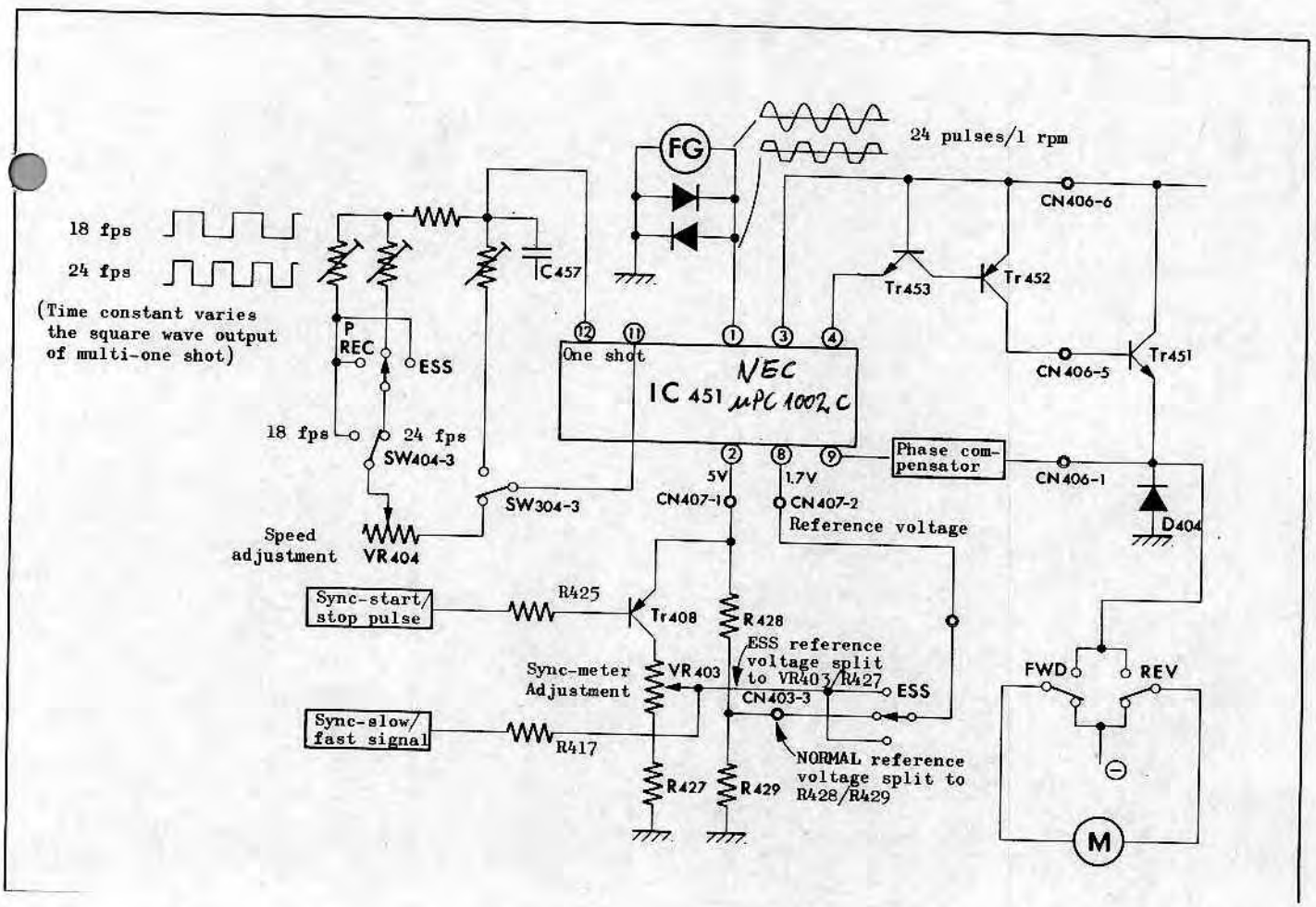
STILL/ON+REV



Governor Circuit

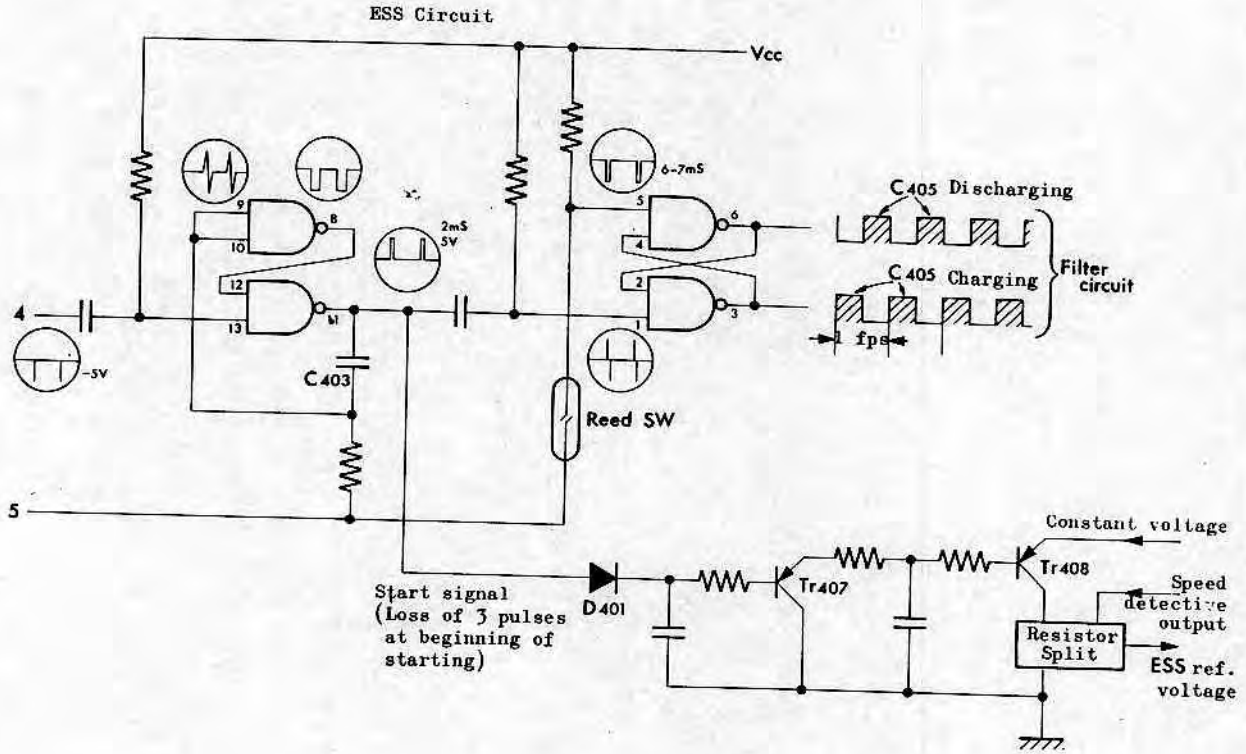


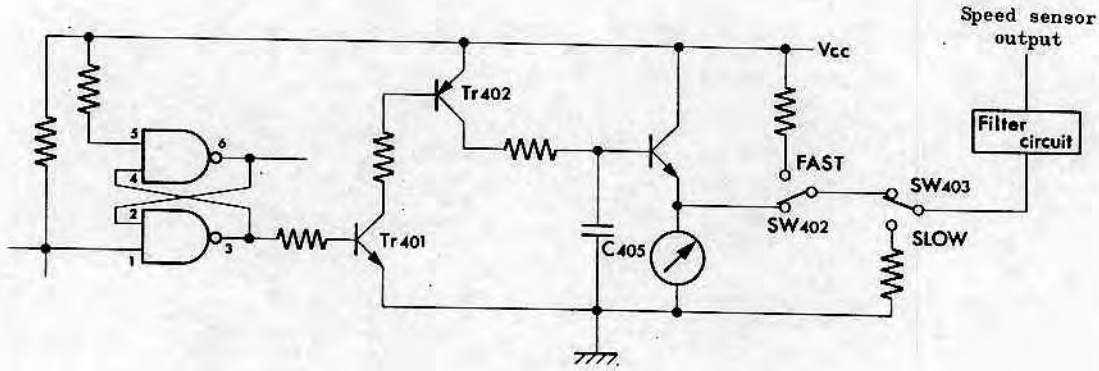


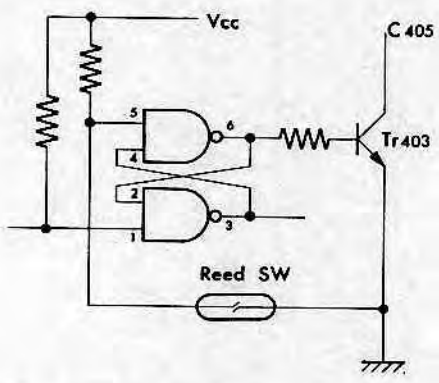


f. ESS Circuit

ESS is the pulse talkie system controlled by the built-in pulse control circuit.







PULSE IN:

When negative pulse goes into 1-pin, the output at 3-pin changes to 1 and C405 is charged. Since the output at 4-pin changes to 1, that at 6-pin changes to 0 and that at 2-pin becomes 0. Therefore, the output at 3-pin keeps 1.

REED SWITCH ON:

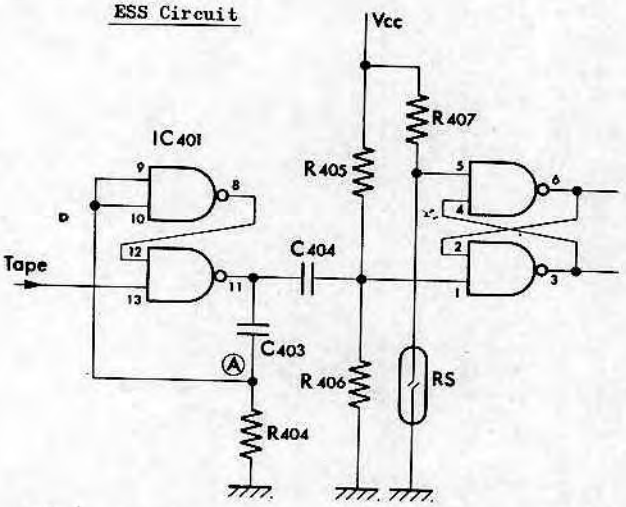
When reed switch is ON, output at 5-pin changes to 0 and that at 6-pin changes to 1. Therefore, C405 is discharged. Since the output at 2-pin becomes 1, that at 3-pin changes to 0 and that at 4-pin becomes 0. Therefore, the output at 6-pin keeps 1.

SYNCHRONIZATION:

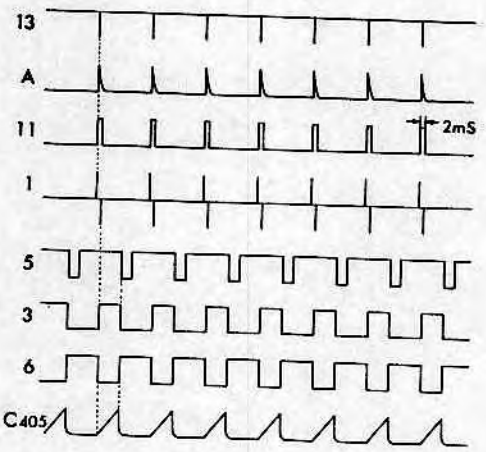
The residual electric charge in C405 is a control output.
If the motor runs fast, the charge of C405 decreases.
If the motor runs slowly, the charge of C405 increases.
Synthesis electric charge is smoothed and it is led to split circuit of ESS reference voltage.

f. ESS Circuit (Cont'd)

ESS Circuit



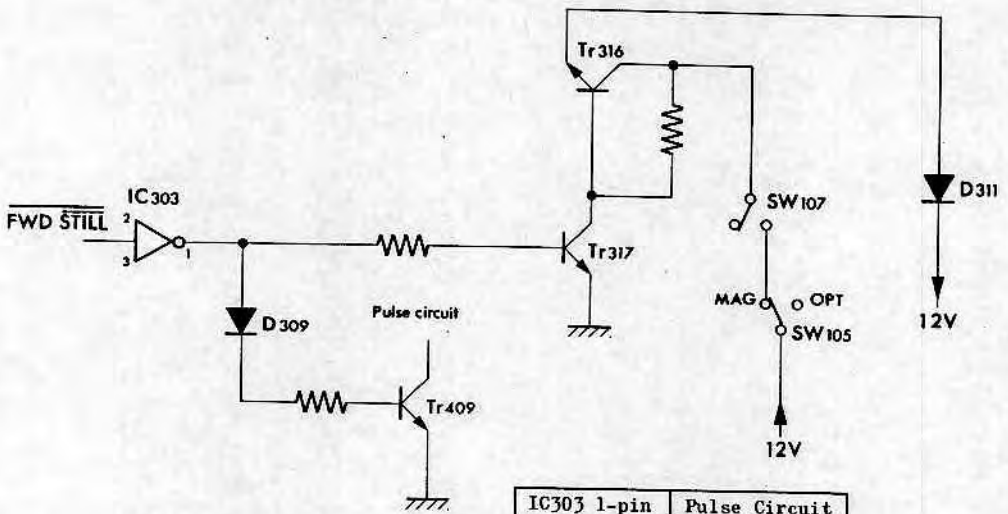
Timing Chart



Voltage at each pin:

No pulse from tape (Still condition)		When negative pulse puts into 13-pin from tape		Remarks
(A) -point	Low	13-pin	Low	* as far as (A)-point is High.
9/10-pin	Low	11-pin	High ... *	
8-pin	High	C403	Charged	** The output at (A)-point returns to Low after the time (fixed by time constant of C403 & R404) and the projector returns to the still condition.
12/13-pin	High	(A)-point	High ... **	
11-pin	Low	8-pin	Low	
C403	Discharge	12-pin	Low	

Pulse Recording Power-Supply Circuit



IC303 1-pin	Pulse Circuit
LOW	ON
HIGH	OFF

Projection
FWD
REV/STOP

Tr317	Tr316	D311	Pulse Rec. Power
OFF	ON	12V	ON
ON	OFF	0V	OFF

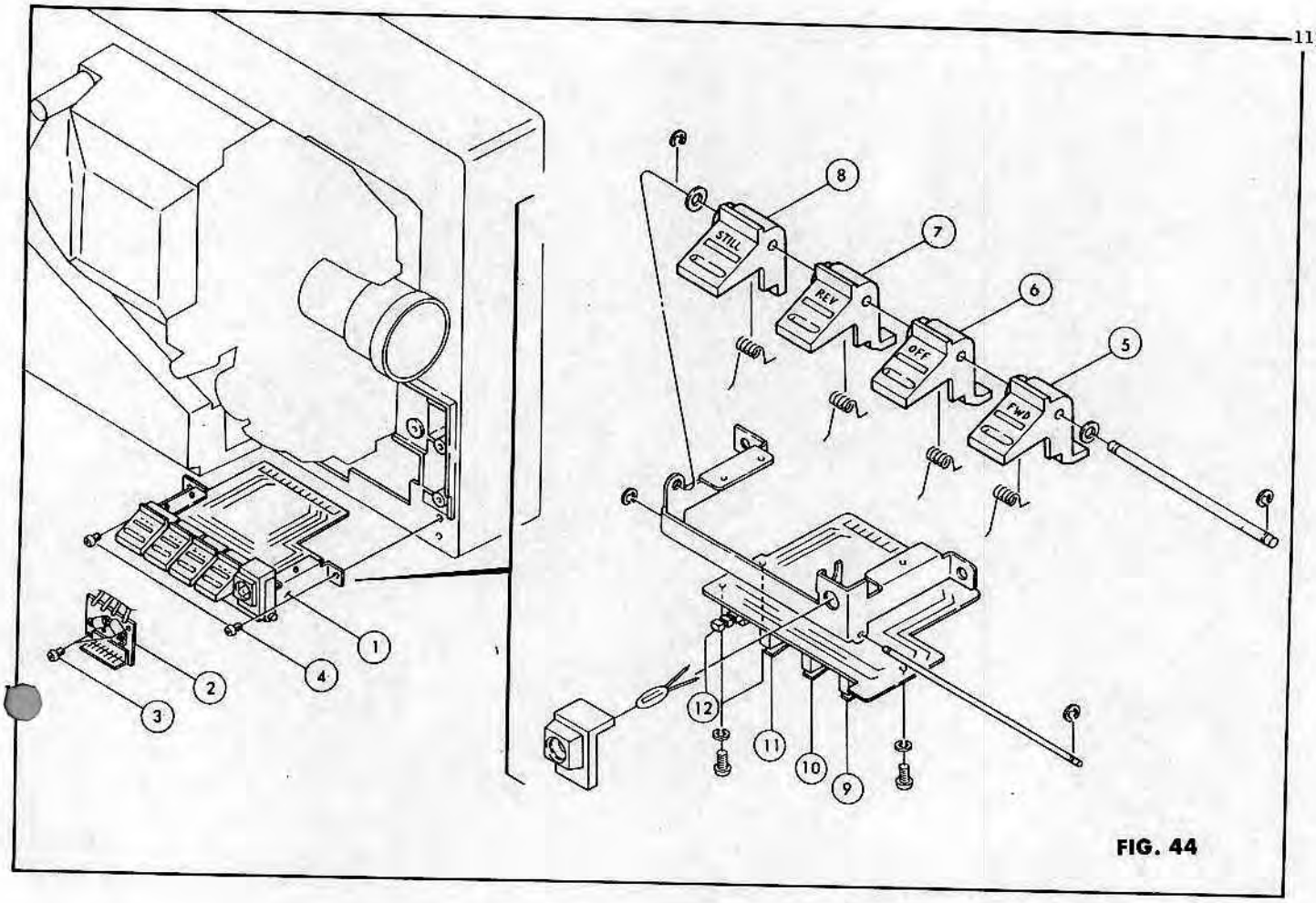


FIG. 44

8. OPERATION SWITCH UNIT (1)

TROUBLESHOOTING: (Refer to Fig. 44)

Unable to lock the STILL button	The (1) is out of position. Attach the (1), pushing it upward.
Motor doesn't run though operator pushed FWD button	The (5)(9) are defective or connectors are half-connected.
Motor doesn't stop though operator pushed OFF button	The (6)(10) are defective or connectors are half-connected.
Motor doesn't run though operator pushed REV button	The (7)(11) are defective or connectors are half-connected.
STILL projection system isn't workable though operator pushed STILL button	The (8)(12) are defective or connectors are half-connected.

DISASSEMBLY:

1. Unscrew the (3)x2 and lift the (2) up slightly. Don't touch the cancel coil on the (2).
2. Unscrew the (4)x2 and remove the (1).
3. For further disassembly, refer to Fig. 44.

REASSEMBLY NOTES:

1. Follow the reverse way of the disassembly steps.
2. Make sure that each button and switch functions well.

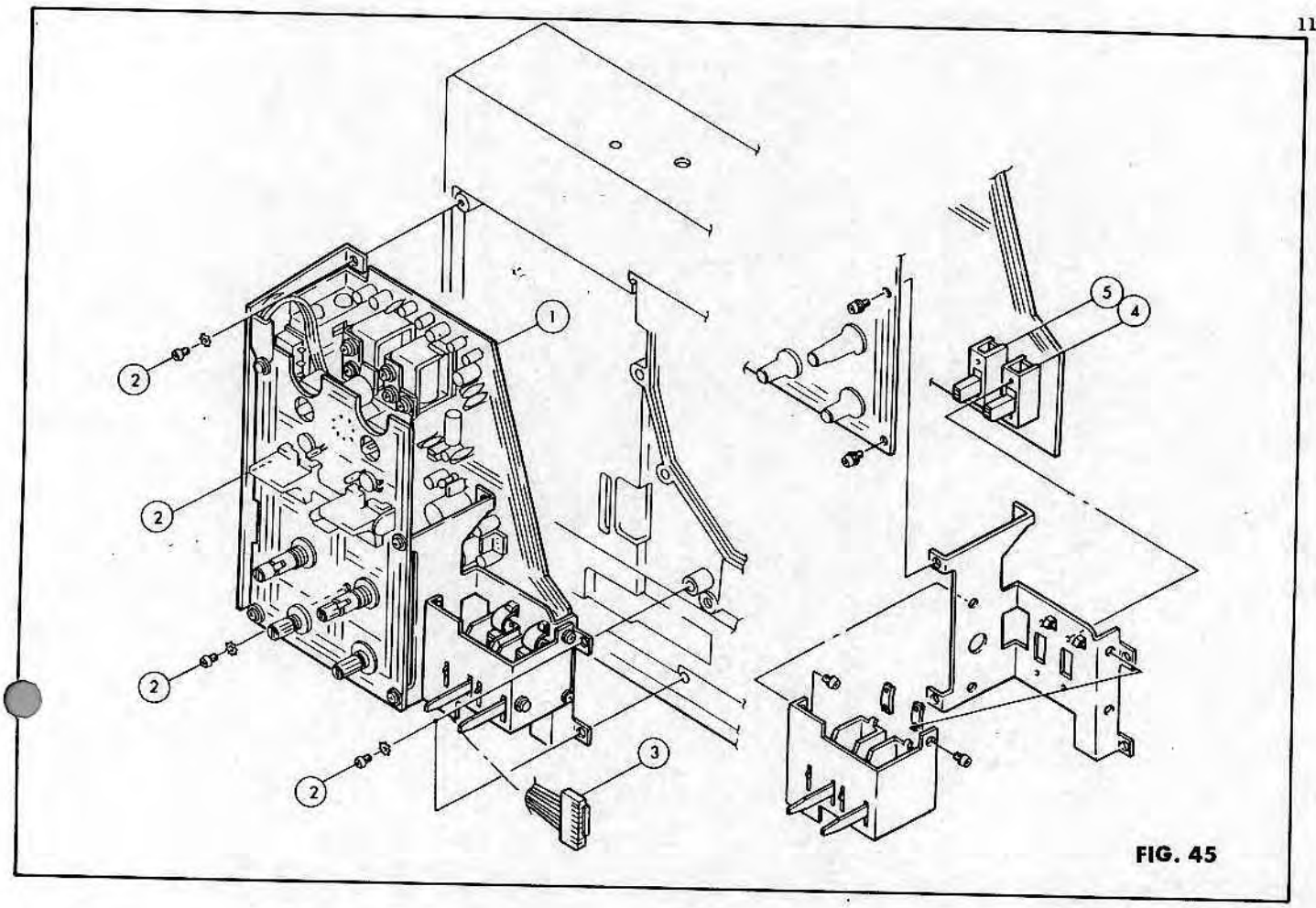


FIG. 45

9. AMPLIFIER SECTION

A. Amplifier Assembly

TROUBLESHOOTING: (Refer to Fig. 45)

Unable to shift MAG-OPT	The (4) is defective.
Unable to shift STEREO-MONO	The (5) is defective.

DISASSEMBLY:

1. Unscrew the (2)x4 and pull out the (3) after cut a beaded binder.
   The toothed lock washers are used under the (2).
2. Remove the (1), pulling it toward you.
   Note that the (1) is connected to the projector with connector.
3. For further disassembly, refer to Fig. 45.

REASSEMBLY NOTES:

Follow the reverse way of the disassembly steps.

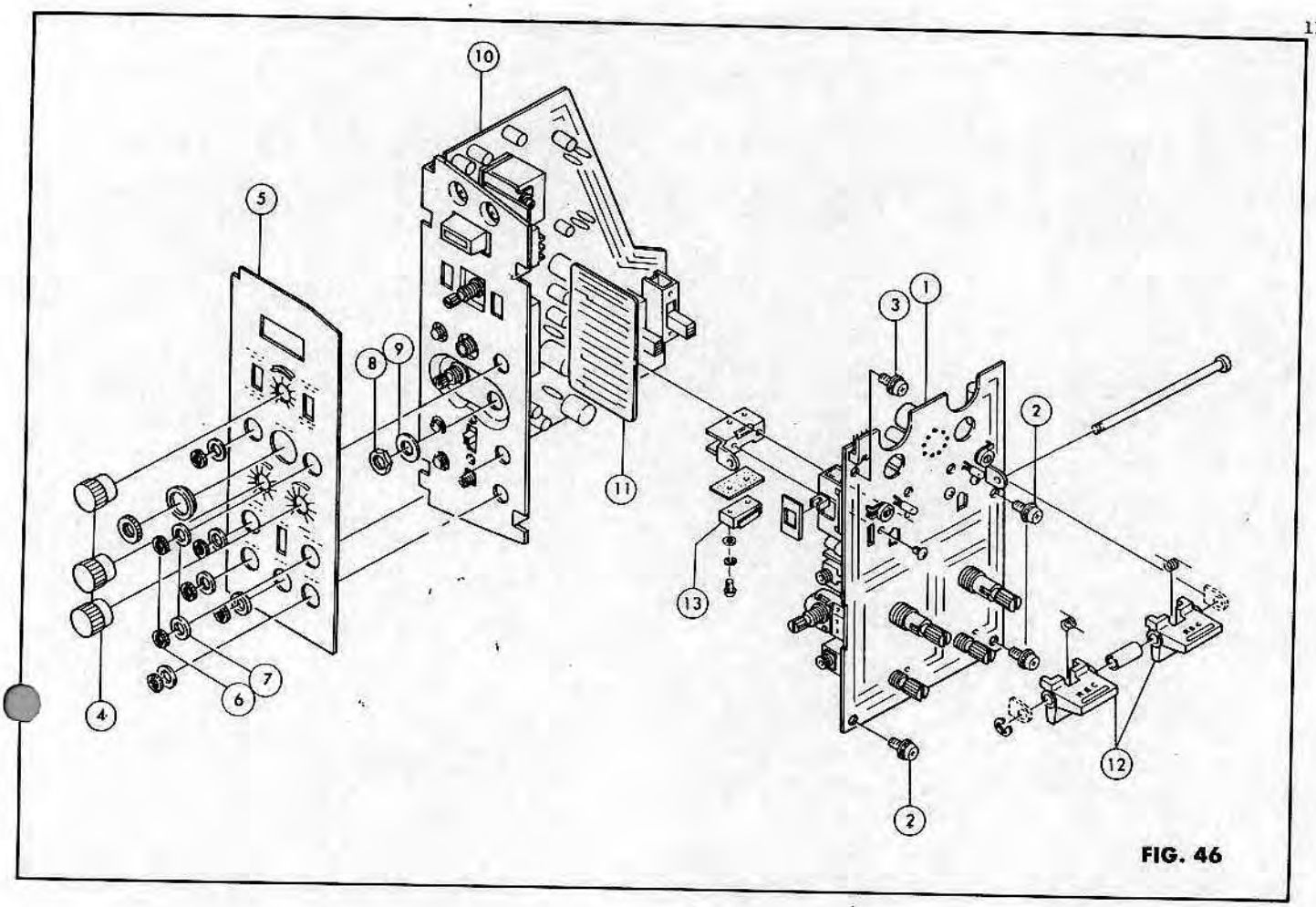


FIG. 46

A. Amplifier Assembly (Cont'd)

How to detach the amplifier board (1) from the amplifier board (10) --

TROUBLESHOOTING: (Refer to Fig. 46)

Spot recording malfunctions	The (3) is too long.	
REC button movement isn't smooth	The (12)(13) are defective.	
Volume knobs don't turn smoothly	Knobs are out of position.	
Defect of amplifier		from Page 123 forth

DISASSEMBLY:

1. Unscrew the (2)x3, & (3). Remove the (4)x3 and peel the (5) off.
2. Unscrew the (6)x2 with (7), and the (8) with (9). Detach the (1) from the (10).
3. For further disassembly, refer to Fig. 46.

REASSEMBLY NOTES:

1. Attach the (11) between the connectors of (1)(10) carefully not to touch resistors, capacitors, etc.
2. Attach the knob to the center of (5)'s hole respectively.
3. Don't forget to insert the isolation washer when tightening the jack.

B. Amplifier Design

1. Stereo Circuit

The GS-1200 uses Track 1 as the left channel and Track 2 as the right channel.

It is possible to operate each channel independently.

The public address (PA) system and optical playback circuit are connected with only the left channel. One piece of bias oscillator is used for both channels.

2. Remote Recording

Solenoids are used for recording-playback changeover, so the operator can operate the changeover by remote controller.

With use of remote controller, the pulse operation is easy and the microphone will not catch any projector running noise. Refer to Page 160.

3. Level Meter of Constant Level

There is an exclusive amplification circuit (not affected by volume/tone position) for the AUX OUT/Level Meter system added to the amplification circuit for the speaker system.

The level meter can indicate the level of recorded sound as it is. With this facility, it is easy for operator to add other sound with equal level. Refer to Pages 156 and 157.

4. Muting Circuit

a. For playback:

To reduce or eliminate the noise (click noise on switch ON/OFF operation and other noise), control signal for muting flows into the overload transistors (Tr101, Tr201) which are used for the ALC circuit on recording.

The muting system works on STOP/REV/STILL/AUTO-THREADING, but it does not work when the PA switch is ON. Refer to Page 158.

b. For recording:

Photo coupler is used in order to mute the recording current.
This photo coupler turns ON (muting is released) when not only the REC button but also FWD button is pushed. Therefore, when only the REC button is pushed, recording current doesn't flow into sound head. Refer to Page 161.

5. Bias Control

To reduce click noise on recording, the bias oscillator works when not only the REC button but also the FWD button is pushed.

6. Recording Amplifier (Tr102, Tr202)

To aboid the tone control on recording, there is an exclusive amplifier for recording.

To compensate the phase shift between each input/output terminal for stereo performance, this amplifier is designed as an inverted amplifier. The phase, which is once inverted by the head switching circuit, will be compensated. And the operator can transfer the sound on one track to another track without phase shift. Refer to Page 159.

7. For superb sound performance, the tone control for Bass is also provided.

8. High-Cut Filter for Transferring Sound

To allow the sound transfer between tracks, a high-cut filter is connected to the playback circuit. When you set the Track 2 side to the recording condition, the Track 1 filter will function because of a crossover connection as shown in Fig. 47. Refer to Page 157.

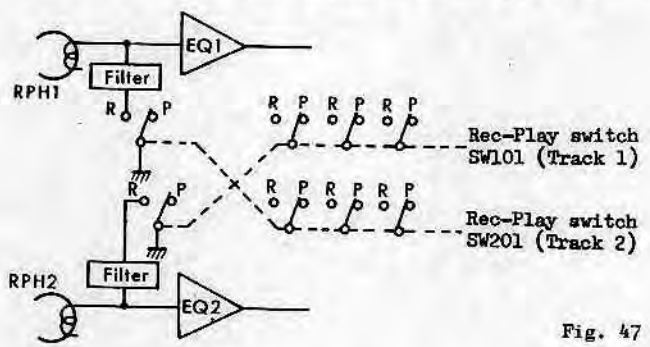


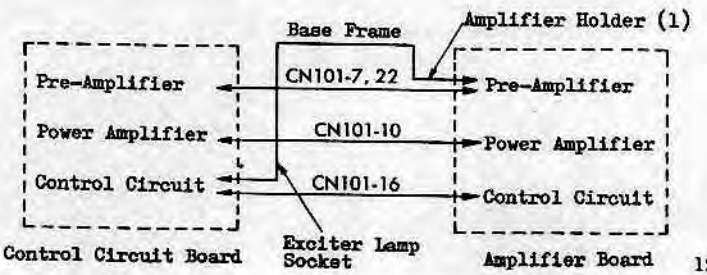
Fig. 47

9. Transistor Switch

To reduce the number of switch and wire, transistor is used as switch (Tr105, Tr106, Tr107, Tr108, Tr111, Tr205, Tr206 & Tr207).

10. Earth

To prevent noise and oscillation, the earth circuit on the amplifier printed board is devided into three units -- Pre-amplifier unit, Power amplifier unit and Control unit -- and is respectively connected to the control circuit printed board as shown in the schema. Each point is not affected.



C. Switches, Jacks, Variable Resistors and Connectors in Amplifier Circuit

SWITCHES:

SW No.		Switching	Track	Fig.	Remarks
1	SW101	REC-PLAY	1		Workable by solenoid
2	SW201	"	2		"
3	SW102	NOR.-DOUBLE REC	1	50	
4	SW202	"	2	50	
5	SW103	for REC	1	48	
6	SW203	"	2	48	
7	SW104	Voltage	1		for solenoid
8	SW204	"	2		"
9	SW105	MAG-OPT		49	
10	SW106	STEREO-MONO		49	
11	SW107	READY-OFF		50	
12	SW108	for SPOT REC		50	
13	SW109	ALC-OFF-PA		50	

JACKS:

Jack No.		Purpose	Track	Fig.
14	J101	MIC	1	50
15	J201	"	2	50
16	J102	AUX IN	1	50
17	J202	"	2	50
18	J103	Monitor	1	50
19	J203	"	2	50
20	J104	AUX OUT	1	54
21	J204	"	2	54
22	J105	Headphone		50
23	J106	PA MIC		50

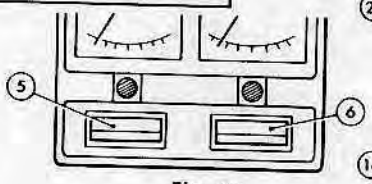


Fig 48

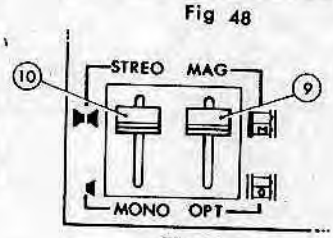


Fig 49

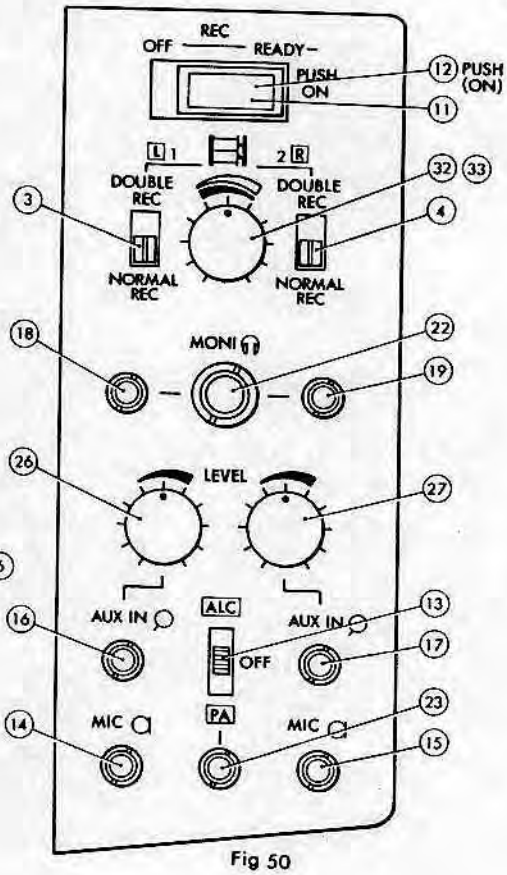


Fig 50

VARIABLE RESISTORS:

VR No.		Purpose	Track	Fig.
24	VR101	Volume control	1	53
25	VR201	"	2	53
26	VR102	AUX IN level	1	50
27	VR202	"	2	50
28	VR103-1	TREBLE	1	53
29	VR103-2	BASS	1	53
30	VR203-1	TREBLE	2	53
31	VR203-2	BASS	2	53
32	VR104-1	DOUBLE REC (linked)	1	50
33	VR104-2		2	50
34	VR105	Bias adjustment	1	
35	VR205	"	2	
36	VR154	AUX OUT level meter adjustment	1	
37	VR254	"	2	

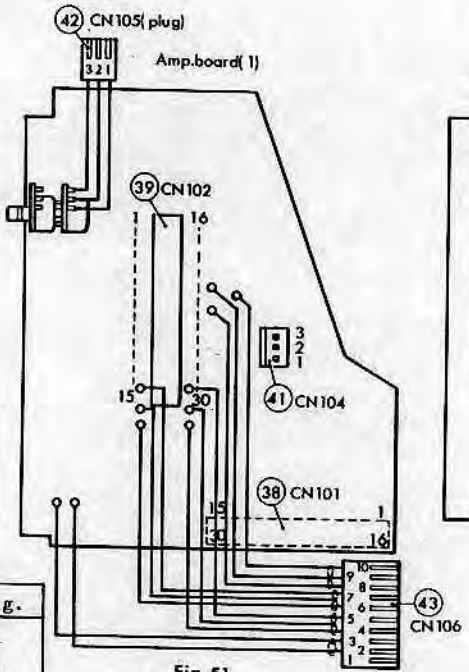


Fig 51

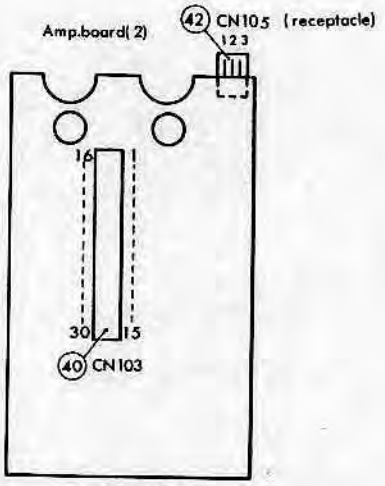


Fig 52

CONNECTORS:

CN No.		Connection		Fig.
38	CN101 (30P)	Amp-board (1)	Control circuit	51
39	CN102 (30P)	" (1)	Amp-board (2)	51
40	CN103 (30P)	" (2)	" (1)	52
41	CN104 (3P)	" (1)	Level meter	51
42	CN105 (3P)	" (2)	DOUBLE REC level VR	51,52
43	CN106 (10P)	" (1)	Cancel board	51
44	CN107 (3P)	Built-in SP	Control circuit	
45	CN108 (2P)	(DIN)	Ext. Speaker (1)	54
46	CN208 (2P)	(DIN)	" (2)	54

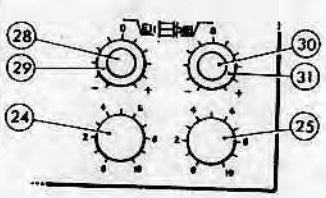


Fig 53

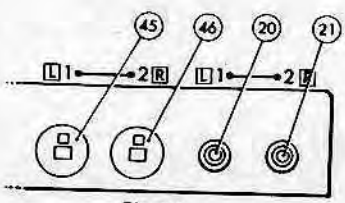


Fig 54